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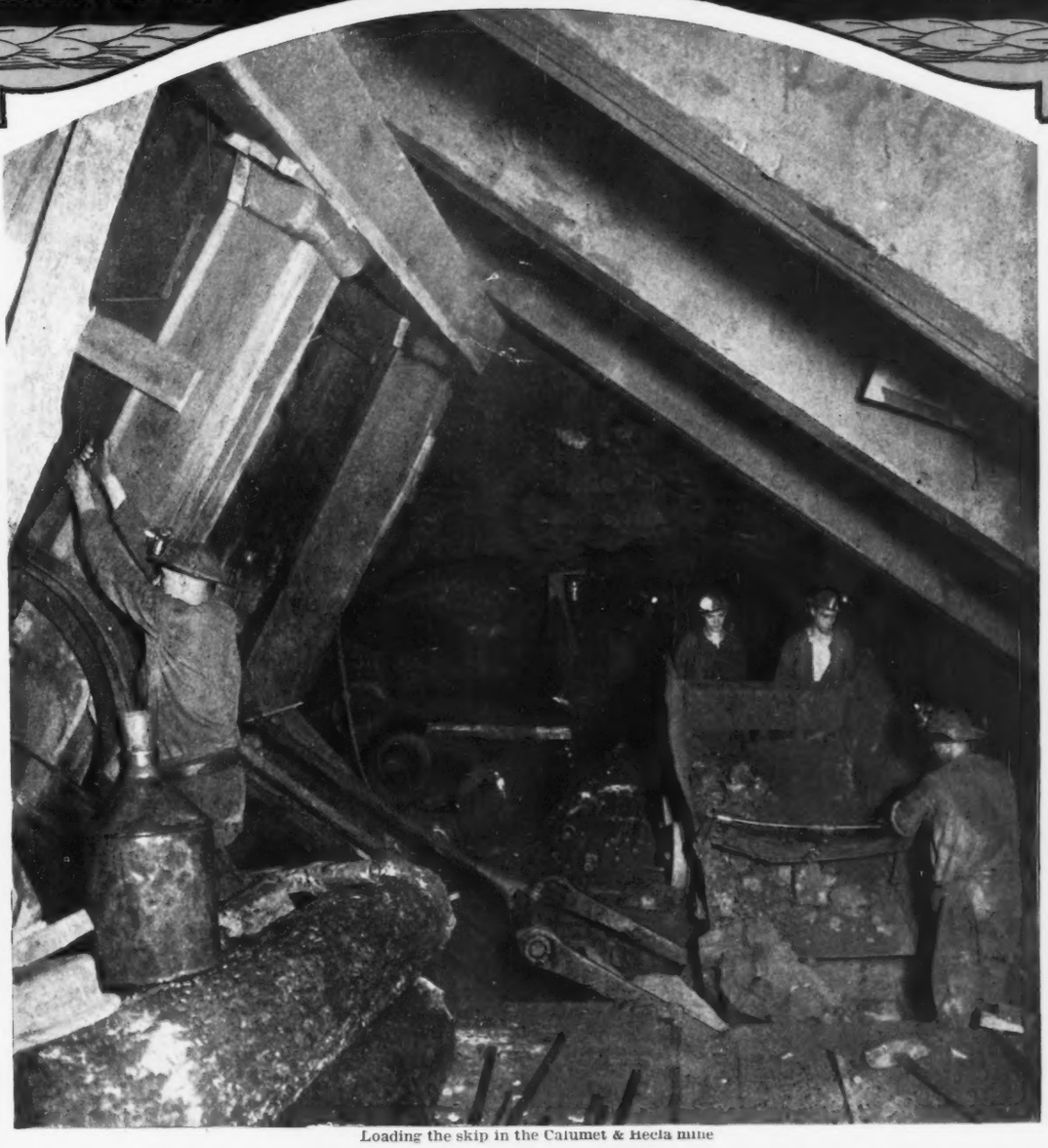

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A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

August 18, 1923

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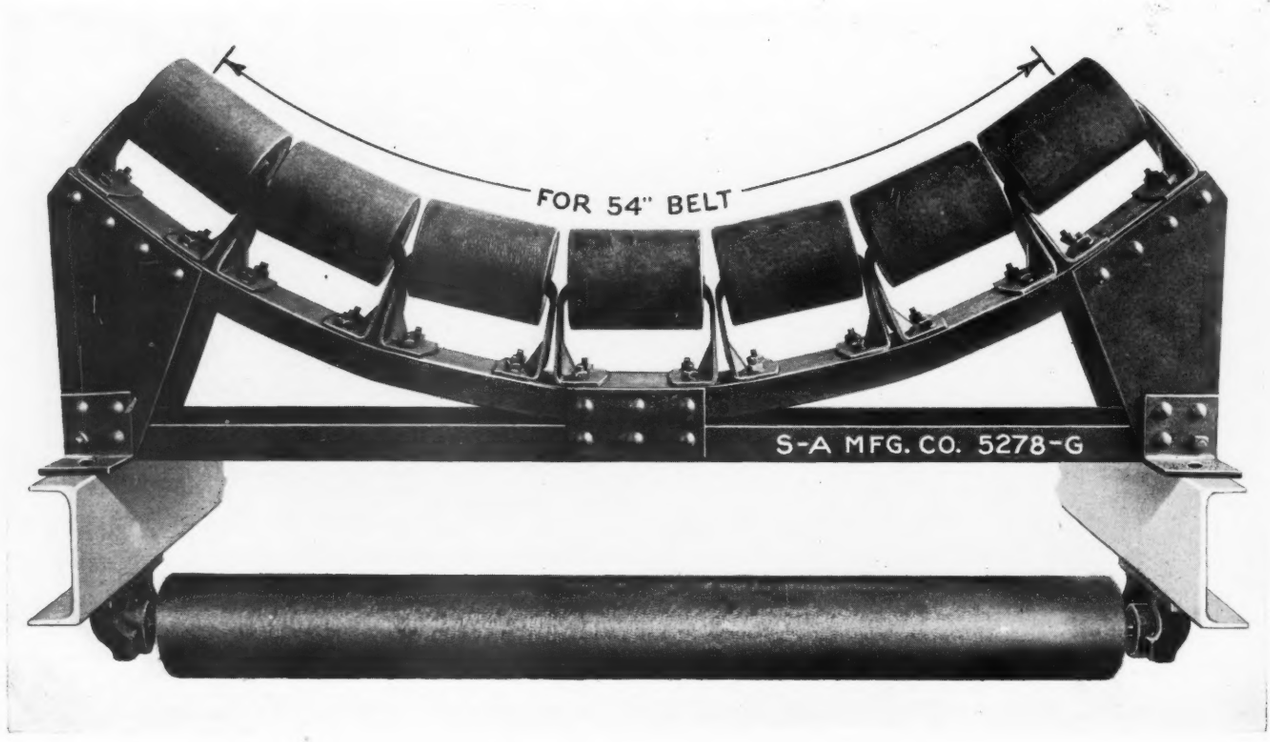

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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 116 | New York, August 18, 1923 | *Number* 7

Safeguarding Earnings From the Fire Hazard

INSURANCE is a fine thing when one is in trouble, but it is an expense absolutely without return so long as the unforeseen does not happen. A brilliant example of its benefit may be seen in the position of the Hecla Mining Co. since its recent fire. A fire loss of about half a million dollars was suffered, but possibly even greater than this will be the loss due to the necessary cessation of operations during the time that will be required for rebuilding. The fire insurance amounted to $337,000, distributed among several companies. Most mining companies would be satisfied with this and consider themselves sufficiently protected. But the Hecla management realized that its eggs were all in one basket and that a serious fire would simply put the company out of business until the damage could be repaired; furthermore, it realized that the property, with its large amount of timbering and its hazardous location, was more likely than many others to have a serious fire. Accordingly, what is known as "use and occupancy insurance" to the amount of $1,000,000 was taken out in addition to the regular fire insurance. This, according to our informant, is payable at the rate of $2,740 daily for one year from the date of the fire unless within that time the company is able to resume use and occupancy of its plant. Thus the company is unlikely to suffer financially to any marked degree as a result of the conflagration.

Herein is a lesson for many other companies similarly situated. It is a subject which should be discussed by the board of directors of every mining company, especially when the company is a small one that is likely to be unable to weather such a shock and when all its properties are in one place. It is also suggested that it is more advisable to take out such insurance when the price of the metal produced is high; otherwise it may not make much difference whether the plant operates or not. Some copper companies, for example, would be little worse off right now if their employees were busy rebuilding a burned plant on which sufficient fire insurance were carried than if they were producing copper.

Companies and individuals unable to stand losses from fire are usually the ones that are the least protected. The managements of large and successful companies seem more thoroughly to understand the advantages of insurance, and protect their properties adequately even though a localized fire might not make a great deal of difference to the financial condition of the company as a whole. Of course, with a small company having trouble to make both ends meet, an allocation of sufficient funds to pay for adequate insurance might be the straw that would break the camel's back; but before the first dividend is declared the directors should take steps properly to safeguard the property of the stockholders from fire.

Straight fire insurance is the first consideration for the securing of utmost protection where funds are scarce. Rates can be brought to a minimum by adequate fire-preventive appliances. Then, as more funds are available, added protection can be secured through some of the modern forms of insurance such as that taken out by the Hecla company.

Insurance Also a Personal Problem

INDIVIDUALS as well as companies are too often underinsured. How many readers of this journal have their personal property covered to the extent of its replacement value? How many have even taken the trouble to make an inventory of their possessions, thus finding out, probably, that the value of what they own is about twice what they thought it was? With the increased prices of materials nowadays, and the occasional additions made to almost every one's material possessions, it is probable that if a policy of $5,000 were sufficient coverage ten years ago, one for $10,000 should be in force today. About $5, the price of this journal, will secure $3,000 worth of fire insurance for one year.

Life insurance is generally realized to be a good thing, but still how we hate to be bothered by insurance agents, particularly if we are carrying only about one-fourth as much as we should! Here, again, it is the older and more well-to-do men that are usually the best protected. A young engineer finds that the annual premiums on even what insurance he is carrying are hard to meet, and reasons with some truth that the sacrifices necessary in his mode of living, for the provision of adequate insurance, would be too great to be advisable. The trouble in many instances is that he has the wrong kind of insurance; he has an expensive endowment when what he should have is a term policy, by which, for a certain small sum he is protected for a certain term of years. This form of insurance is not pushed by the insurance companies, but is the best kind for one who has large responsibilities and a closely limited amount available for protection.

Progress of Industrial Development

THE LEGEND runs that in old New Amsterdam, as a worthy burgher sat placidly smoking beside the Hudson, a vision came to him of a greater city that was to be. Lofty towers and buildings, the like of which he had never seen, took shape before his eyes through the smoky haze, a scene so marvellous that, in his Dutch stolidity, he knew it could be due to naught but overindulgence in tobacco or to indigestion.

We are less prosaic. Present achievement stimulates the imagination, and there is almost nothing that we will not concede that the future may bring about in the way of material development. We have come to feel that within the mind of man lies the power, like

the talisman of Aladdin's lamp, to evolve eventually whatever it may desire. Thus the loftiest idea may have its realization, and advancing toward such a goal what may we not accomplish!

The industrial world today is full of wonders, and yet how crude! We live in an electrical age, they say, yet what a vast deal of our water-power goes to waste! In the complete electrification of industry alone what possibilities there are! What energy is spent in mining and hauling coal in millions of tons, when by electrification the same purposes could be so beautifully and simply attained! An electrical manufacturer has recently pointed out, in estimating the opportunities for the future, that only 55 per cent of the manufacturing establishments and mines in the United States are electrically operated, that but 38 per cent of the population are living in electrically lighted homes, and that a still smaller proportion are using electrical appliances. Thus there is in this alone abundant room for improvement.

What this development will mean for the metal-mining industry is purely speculative. No one can appraise the dimensions to which the industry of the future will expand. Electrification means increased consumption of copper and aluminum. But it also means improvement and in the long run greater economy in all operations where machinery is involved. The feeling within us that the best will eventually be achieved leads to the belief that the electric drive will finally triumph over all others unless a superior force is discovered.

Mining and smelting methods in past centuries have been pictured from time to time in these pages. Perhaps some have wondered how it was that the ancients persisted in their crudities for so long a time. But with it may have been the feeling that in certain things their practice did not differ greatly from ours, which is a reflection on the little advance made since then.

A Tribute to Hoover

ON RECEIVING the resignations of the members of the Harding Cabinet, President Coolidge is said to have requested them one and all to remain. Without doubt the loss of some of them would be keenly felt. The "big three," according to Mark Sullivan in the *New York Tribune*, are Hughes, Hoover, and Mellon. Hughes and Mellon, says Mr. Sullivan, are in this group apart because of the importance of their particular offices, as well as because of their ability. But Hoover is in it, he says, in spite of the relatively less importance of his Commerce Department, because of his extraordinary personal ability and because, as a matter of fact, he is so well grounded and so indispensable in many big matters that come up outside the limits of his particular official field.

"As to Secretary Hoover," Mr. Sullivan continues, "in addition to his own department, he is everything that is embraced in the dignity and efficiency of the phrase, 'a competent workman.' He contributes able and faithful trustworthiness for such frequently arising emergencies as coal strikes, unemployment, conservation and a dozen other matters calling for hard work, concentration of mind, and immensely varied knowledge. It was one of the comparatively few easing comforts that Mr. Harding had in his difficult Presidency to know that at any hour, day or night, Mr. Hoover was at the end of the telephone wire, subject to call for any emergency. It was a reliance of which Mr. Harding made frequent use."

Accomplishments of a Business Man

IT IS INTERESTING to note that in the western United States American engineers in the employ of the Bureau of Reclamation have constructed more than one hundred storage and diversion dams with an aggregate volume of 15,000,000 cu.yd., including Arrowrock dam, 349 ft. high, on the Boise River, Idaho, and the Elephant Butte dam, 306 ft. high, on the Rio Grande in New Mexico. The data are from a bulletin of the Department of the Interior. As a result of this work of irrigation development, continues the bulletin, crops amounting in gross value to more than $50,000,000 annually are grown on otherwise arid land in the irrigation projects of the Bureau of Reclamation. This indeed is interesting, all the more so when it is recalled that the Director of the Reclamation Service, who was recently discharged, is the man who is credited with the successful completion of all this work. Yet he was ousted because Secretary Hubert Work, M.D., wanted a "business man in charge."

No Platinum

WHEN THE BOLSHEVIK revolution in Russia cut off the principal source of the world's platinum, it was natural that the production of the metal elsewhere should be stimulated wherever there was any to produce. Russia's normal output was about 300,000 oz. per year. Colombia was, and still is, the only country to contribute an appreciable amount to make up the deficit in the world supply caused by the Russian defection, and in the succeeding years has gradually built up its output to about 30,000 oz. per year, all of it coming from dredging operations. In the United States a total of 3,534 oz. was produced in the six-year period from 1917 to 1922 inclusive, or an average of 589 oz. per year, practically all of it from the black sand from hydraulicking and dredging work in California, Oregon, and Alaska—a negligible amount.

But it must not be deduced from this that there has been no effort to find platinum in the United States. On the contrary it has been keenly hunted. The rise in price from $45 an ounce in 1913 to $118 in June, 1923, has stimulated the efforts of prospectors the country over. It also apparently stimulated their imagination, as well as that of promoters and even of assayers, in many cases to such an extent that the existence of platinum was claimed where there was none. Some people have the remarkable faculty of seeing what they wish to see, and it is unfortunate and detrimental to the reputation of the chemist and the analyst in general when this faculty, so pronounced in Conan Doyle and Oliver Lodge and others, is acquired by the assayer. Within the last few years there have been repeated stories of discoveries of platinum in varying amounts, usually backed up by an assayer's certificate. Three of these involved promotions which have already been scotched, some of the promoters landing in jail. All of these cases have been investigated by the Bureau of Mines, and the report is unfavorable.

To warn the public and the mining industry, therefore, lest it be deceived, the Bureau has issued an interesting report of its investigation, which is entitled "Platinum Assays and Platinum Promotions," prepared by S. C. Lind, C. W. Davis, and M. W. von Bernewitz. It was during the war that its Rare and Precious Metals Experiment Station was authorized to make quan-

titative analyses of platinum, among other war minerals. In an effort to determine whether the United States had any important resource of that metal, the Bureau has analyzed a large number of samples, these coming from all mining states in the country. Its findings are contained in the report.

Forty-four specific cases are listed where the Bureau could find no platinum, though custom assayers had reported favorably on other samples from the same ground. The names and addresses of these assayers are given, with the results obtained, together with the names of those assayers whose results agreed with those obtained by the Bureau. It is difficult to see how the first-mentioned can justify themselves.

It is pointed out in the report that there is no reason why assayers should not be familiar with reliable methods for determining platinum; also that the metal does not exist in a form that cannot be detected quantitatively by the regular methods. The latter disposes of the contention frequently made by fakers that "the platinum is in the ore, but can be determined only by special and, of course, secret methods."

Anyone interested in platinum and platinum promotions will find the report of value. The outstanding fact in it, however, is that to date no domestic platinum resource worth mentioning has been discovered.

Tobacco Underground

AN IMPORTANT TEST has just been completed by the Department of the Interior in an effort to determine whether smokers in confined indoor spaces run any risk from the carbon monoxide in their tobacco smoke. Three "subjects" were turned loose in a chamber of 1,000 cu.ft. volume and given *carte blanche* as to what they would have to smoke. Everything from coffin nails and Peerless to choice Havanas was theirs for the asking for the space of several hours. Finally when they could no longer see—because of the murky atmosphere, of course—time was called and samples were taken of the air and of the smokers' blood. In no instance did the scientists find that the air contained more than one-hundredth of 1 per cent of CO. The blood saturation was not over 5 per cent.

The test is supposed to have some bearing on the subject of gas hazards in mines. At any rate, these medical studies that have recently been undertaken by the Interior Department will interest many. The effect of cigarette ashes on the corrosion of mine rails might also be looked into, while the department is about it.

The Worker's View of the Twelve-hour Shift

ONE OF THE MOST POIGNANT comments on the twelve-hour shift is that of Don Marquis, the columnist of the *New York Tribune*. He speaks from the standpoint of the working man, and from a hatful of personal experiences. Now that the economists and sociologists have had their say on both sides, it is curious to get the contribution of the worker, from one of the few who have become publicly articulate. Don Marquis recalls two or three years that he worked at farm labor.

"We remember a job that we once had that worked us fifteen hours a day . . . plowing corn and making hay.—We got up at 4 in the morning and went to bed at 9 at night.—We had hired out at a dollar a day and board, and after we had been at it about two weeks the farmer told us that we were worth but 80 cents a day.—He was a liar, and if we meet him in hades we shall shove at least one red-hot splinter of cinder slag between his eyeball and his eyelid and tell him to look cheerful.

"For two or three years we did manual labor of that sort, and, after several farm experiences, working ten hours a day on such things as canal, bridge and railroad construction (at from $1.35 to $1.75 a day and board yourself) seemed light work in comparison.

"We have never had any experience in mills or factories, but it is our guess that working ten hours a day outdoors is easier on a man than eight hours in a building.—Men on railroad construction work, etc., find ways to save themselves. You can always stand with your mouth open, staring at vacancy for two minutes, before you get bawled out.—But ten hours a day, even in the open air, shoveling gravel, tamping ties, shifting rails with crowbars, shoveling crushed rock out of gondolas, etc., is no joke; it dulls the brain. It is no wonder to us that many men with no education to speak of, with no special aptitude, with no chance to learn a trade of any sort, with no influential friends, prefer to be hoboes part of the time to being unskilled laborers all the time.—We came so near turning into a hobo one summer that (we realized later) some people actually thought we were one.—We were working on a canal-building job for $1.75 a day; we got board, such as it was, for $4 a week.—A simple mathematical calculation showed us that we could work three days a week and receive $5.25, or $1.25 in excess of our real needs; this $1.25 we spent on tobacco and riotous living.—It was so easy we tried the system on a number of jobs that summer; work was plentiful.—We did not amass wealth, but we saved ourselves from becoming altogether stupefied.—We had four days of the week in which to lie in the shade, smoke, read, think and form the acquaintance of many traveled gentlemen of leisure whose morals and habits were not precisely immaculate, but whose personal experiences had frequently been interesting and vivid."

On reading this over it strikes us that here, after all, is in a sense a sociological and an economic contribution to the question.

Zinc Poisonous at Times

EXAMINATION of the ash of many food products has disclosed the presence of appreciable quantities of zinc, as was pointed out in the *Journal of Biological Chemistry* for June, 1919. But, hold! Lest faddists rush to zinc shavings for breakfast food, especially in cyanide plants, where they may easily be had, just as people were recently taking yeast—and, by the way, baker's yeast contains zinc—it will be better to consider carefully a bulletin of the Department of Agriculture warning against using galvanized iron utensils as containers for food or drink. Some of the zinc, it is said, will probably be dissolved and not only give the food a bad taste but may also cause illness.

It may or may not be a case of one man's meat being another man's poison. Doubtless the galvanizers will take advantage of the occasion to put an even thinner coating on their sheets. This is a matter for the Zinc Institute to look into. Public prejudice works in queer ways at times, and once a movement to discontinue the use of some commodity or manufactured product starts, there is no telling how it will end.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Why Is a Dollar?

THE EDITOR:

Sir—When our first mint laws were enacted, on April 2, 1792, Congress named 371¼ grains of pure silver a "dollar." Our government then began an experiment in bimetallism which, ultimately, proved to be unsuccessful, because both gold and silver are commodities whose exchange values are determined by trade and commerce, and not by the legislation of any country or nation, excepting in so far as any such legislation may increase or diminish the demand for the two principal money metals by adopting or rejecting them, either or both, for money purposes.

In the vain effort to overcome the troubles that were caused by the almost constant variations in the relative exchange values of the two metals, which variations were due to changes in the commercial ratio, our coinage laws were modified at various times, up to March 14, 1900, when the present law was passed. In part this law is as follows:

Be it enacted, etc., "That the dollar, consisting of 25.8 grains of standard gold, nine-tenths fine, . . . shall be the standard unit of value."

It should be observed that the law does not say that the gold must be coined before it becomes "the dollar"; though, no doubt, it will be contended by many people who do not know any better that that was the intent of the law, because such people think that a "dollar" must, necessarily, be a coin or else a paper bill with the imprint of the government upon it, to give it value. The complete fallacy of such a line of argument will be disclosed in what follows:

An assayer weighs the gold obtained from samples and, from the weights so found, he calculates the quantity of gold in terms of "dollars." Now, according to our present coinage law, each of such "dollars" is 23.22 grains of pure gold. Hence, if the ore is found to contain 116.1 grains of gold per ton, for example, it is said to assay $5 per ton. Each 23.22 grains of gold in the ore is a "dollar," although it is not coined.

Please note carefully that all of the uncoined gold in the ore is calculated in "dollars" upon the exact basis of the number of "dollars" it will produce when it is coined by the mint. Consequently it must be "dollars" when it is in the ore or in the alluvial gravels or in gold jewelry, or in gilt letters or any other form in which it may exist, including sea water or any other solution containing gold, just as much so as it is "dollars" when it is in the form of bullion, or standard gold coin.

Of course, a "dollar" in the ore in a mine is not worth as much in exchange value as is another "dollar" in the form of a coin, because it will cost a good deal, relatively, to get a "dollar" out of a mine and into the form of bullion, which latter condition is the state which the coined "dollar" is in when it is prepared for use as money. The stamp of the mint simply tells the weight and fineness of the coin. It may cost more than a "dollar's" worth of labor, material, etc., to put the "dollar" that is in the mine into merchantable form—that is to say, into gold bullion. It is because of this latter reason that John Stuart Mill stated, so very truly, that "the exchange value of gold is determined temporarily by supply and demand, but permanently, on the average, by the cost of production."

Inasmuch as the mint manufactures gold bullion into coin free of charge (free coinage), it at once becomes manifest that such manufacture does not add to the money value of such bullion; for, if it did enhance its value, the government could not afford to coin it, free.

Again, gold is unlimited legal tender between all nations, practically, a condition that does not obtain with respect to any form of money. For example, when foreign money, meaning gold coins such as sovereigns which in reality are simply gold bullion made up into small pieces called coins, is sent here in adjustment of trade balances, for example, it is all uncoined before full payment is made for it, because in the form of foreign coins it is not legal tender in this country. Such foreign money is first weighed before even partial credit is given for it, then it is melted down and cast into bars, after which it is weighed again and assayed to find out the amount of pure gold it contains, because it is the pure gold, alone, for which full payment is made. The reason for such procedure is to eliminate the possibility of loss from counterfeit or light-weight coins.

As a further illustration of the truth of this line of argument, let us consider some facts bearing upon our own gold coins, a ten-dollar gold piece, for example. When such a coin comes fresh from the mint, it contains 232.2 grains of pure gold (within the limits of tolerance). The device of the mint is stamped upon it simply and solely to tell the world that the sovereignty of the United States of America declared that it contained 232.2 grains of fine gold, when it was so manufactured. But, after it first leaves the government's possession, the government is no longer a guarantor of its gold contents; because, unfortunately, there are dishonest people in this world and, sometimes, one of that class will mutilate gold coins for the purpose of unfair gain. It is unnecessary to inquire into the methods that are employed for that purpose; suffice it to say that it is possible to abstract gold from coins in such ways as will defy detection, practically, by an average person. However, all such mutilated coins are quite readily detected by the government's experts and they are then considered to be only so much gold bullion, and are so treated and paid for by the mint. Such a mutilated ten-dollar gold piece is no longer ten "dollars," though the stamp of the mint still clearly outlined upon it says it is ten "dollars"; but it is not ten "dollars" by precisely the weight of pure gold that

it is found to lack. It becomes apparent at once, therefore, that it is not the stamp of the mint that gives a gold coin its exchange value or any part of its exchange value. On the contrary, it is simply its gold contents alone that gives the coin whatever exchange value it may be found to possess.

Hence, according to our present laws, the only real "dollar" of the United States is 23.22 grains of pure gold in whatever form it may be: and it doesn't have to be coined to become a "dollar," though of course it must be coined before it takes on one of the forms of what is now popularly called "money": but a "dollar" is not, necessarily, money at all times and under all conditions.

In conclusion, it may be said that what is called the "mint price" of gold is $20.67 per ounce. Many people contend, erroneously, that the government has fixed that price "arbitrarily," in the sense that it is within the power of the government to fix or determine the worth or exchange value of all other commodities "arbitrarily."

The utter absurdity of such contention becomes apparent if we suppose, for the moment, that our government should imitate China and adopt silver for our standard of exchange value and "arbitrarily" make 23.22 grains of pure silver our unit of exchange-value, and name that a "dollar." In that event the "mint price" of silver would, at once, become $20.67 per ounce: and, other things being equal, our "dollar wheat" would become worth $32.80 per bushel as measured in terms of our new unit of exchange value, though it would still be worth only 23.22 grains of gold.

New York. W. DE L. BENEDICT.

Underhand Square Setting in Australia

THE EDITOR:

Sir—In your issue of Jan. 6 last there appeared an article by R. H. Dickson, on page 5, describing an alleged new method of "mining by underhand square setting." This method has been in extensive use for over twenty years at the Broken Hill Proprietary mine at Broken Hill, where, owing to the prevalence of friable running ground, it was found necessary to adopt such a system of work. One of the publications of the Australian Institute of Mining Engineers issued in 1913 described in detail the method referred to in the article noted. ESSINGTON LEWIS.

Melbourne, Australia.

Nickel in Pennsylvania

THE EDITOR:

Sir—A very serious error was made on page 1,162 of the June 30 issue of the *Engineering and Mining Journal-Press* which ought to be promptly corrected. The statement was made "We believe there *was* a little nickel taken out of the old Gap mine, some forty or fifty years ago."

In 1876, and a number of years thereafter, 6,000 tons of nickel ore were mined annually at the Gap mine, Lancaster County, Pa. Two hundred men were employed, and four large engines in operation at the smelting works, which were also used to keep the mines from overflowing with water. The works were owned by Joseph Wharton, Jr., of Philadelphia, who supplied the United States Mint in that city with nickel for five-cent pieces, and continued to do so until the discovery of the rich nickel deposits near Sudbury, Ontario, Canada, the first samples of which were analyzed in connection with my Harrisburg laboratory—and possibly I am therefore guilty of the cessation of operations at Gap. When mining ceased the deposit had not been exhausted, as I learned by personal investigation a few years ago. While there I observed a good outcropping of copper ore at a roadside, evidently never tested by mining men. HENRY C. DEMMING.

Harrisburg, Pa.

Grinding vs. Calcining

THE EDITOR:

Sir—Referring to the editorial entitled "Grinding vs. Calcining" in the issue of July 7 you state that finely powdered chloride of magnesium, which is non-hydroscopic, is added to cut the salt and prevent absorption of water. Surely you are mistaken in this, as magnesium chloride is the most deliquescent of all salts. Perhaps you meant to state that small quantities of finely powdered magnesium carbonate (crude magnesite) are added to the salt to make it "run" when required. This practice has been adopted by a good many of the salt manufacturers. C. S. MALTBY.

San Francisco, Calif.

"Blue-sky" Laws Make Reader Bluer

THE EDITOR:

Sir—In reference to an editorial regarding "blue-sky" laws published in your issue of July 28, I wish to be permitted to ask a few questions not answered in your editorial. Have you ever known a time when there was as little enterprise and progress in the United States as at present; when there was so much money wasted for pleasure; when there was as much profiteering, graft and dishonesty in the country; when there was as much crime and lawlessness; when the prisons and asylums were as crowded with poor unfortunates; when direct and indirect taxation was as heavy on the people; when the cost of national and municipal governments were as great as at present; when the cost of manufactured products was as high as at present; when the price of farm products as compared with the price of manufactured products was as low as at present; when the cost of living was as high as at present; when there was as much unhappiness and discontent?

What is the cause for this unusual condition? No one is willing to admit the truth even if he knows the facts. But what has all this got to do with "blue-sky" laws? Just this: Every "blue-sky" law is just another "monkey-wrench" thrown into the machinery of progress.

The persistent propaganda directed against fake stock corporations has been doing its work well, and a nicely engraved stock certificate now looks about as inviting to the average man as a bill from his tailor.

We have plenty of bank failures every year; but there is no propaganda directed against fake banking establishments. We have plenty of business failures of all kinds; but no propaganda against fake business houses.

Why pick out new corporate failures and class them all as fakes? Why pick out brokerage houses that fail and class them all as bucket shops?

"Blue-sky" laws may be here to stay, and all that goes with them; death of enterprise, stagnation and dry rot. I personally have no interest in "blue-sky" laws, and am quite content with any laws that pass, good or bad. I even became an immune some time before the Volstead act became a law, but it is a mystery to me where they find so many stupid law makers. X.

George E. Roberts on Silver

A Few Sound Thoughts From a Noted Economist

GEORGE E. ROBERTS

GEORGE E. ROBERTS, vice-president of the National City Bank, has the enviable reputation of being an unusually clear thinker on business matters—political economy, as the professors would have it. Therefore his views on silver, with which he has had long association, both as a former Director of the Mint and as a banker, should be especially interesting to American silver producers on the eve of their conference in Reno to devise ways and means of improving their position. An editor of the *Journal-Press* recently discussed the subject with Mr. Roberts, and among other things asked him, "Is the London 'control' of the silver market harmful to the interests of producers and as arbitrary as some of them would have us believe?"

"I do not believe that the silver market is arbitrarily controlled in London," said Mr. Roberts, "or that the four bullion brokers who set the market can or do oppose market tendencies of the metal. They compare notes daily of sales and purchases and attempt to establish a quotation that represents closely market conditions. It is ridiculous to think that they are making, or can make, exorbitant profits merely by fixing prices unrepresentative of the market—manipulation. I am reminded of the remark a bullion broker made to me some time ago when he said that to estimate profits in the silver brokerage business one should take a silver dollar and rub it on his trousers. The silver remaining on the trousers would be proportional to the profits in the business. I think that the silver market is subject to the same play of economic forces as any other commodity market."

Mr. Roberts' opinion as to the advantages to be gained by the organization of a Silver Export Association which is being currently agitated by some of the producers encourages them to form an association if they think it likely to help them, but he urges caution. "If the silver producers feel that economies can be effected by combining to market their production abroad, by all means let them try it," he said. "The benefits that may accrue to them, however, are liable to be overestimated. A good plan would be to study the results achieved by the Copper Export Association, although the marketing of silver is somewhat different."

Some producers advocate holding silver from the market in an effort to obtain higher prices through a co-operative agency. "Such a policy would be disastrous," declared Mr. Roberts. "The silver should be marketed as produced; otherwise the producers would be speculating and thereby treading upon dangerous ground. Stocks would accumulate that would have to be marketed sooner or later, and the greater the accumulation, the lower prices would ultimately go. An association pursuing this policy would soon become involved in many difficulties. I doubt if it can obtain the support of bankers for such a plan."

Mr. Roberts gave as one of the principal reasons for the present condition of the silver market the extreme price fluctuations that took place during and shortly after the war. "Silver, like a good many other commodities, is suffering from the after-effects of the period of high prices that existed in the open market three years ago," he said. "These prices caused many governments to debase their silver currencies, and I do not think they will easily return to the use of the higher bullion ratios. Great Britain has changed her silver currency from 925 to 500 fine, probably to remain. Italy has substituted nickel coins for silver, and other countries have done the same. Subsidiary silver coins in gold-standard countries are merely tokens, and as such it makes little difference what they are made of. The face value is the same with any bullion content. That is a principle of token money. It would have been far better for silver had prices run on an evener course."

A New Surveying Instrument

Construction and Uses of This Novel Device for Many Varied Purposes in the Field Are Described in Detail by the Inventor

By C. Erb Wuensch
Mining Engineer, New York

COMBINED in a single instrument devised by the author, which he has termed the "reconnoitregraph," there are a swinging compass, a vertical arc, a clinometer, hand level, open-sight alidade, range finder (stadia), and slide rule. By virtue of its unique construction this combination device should

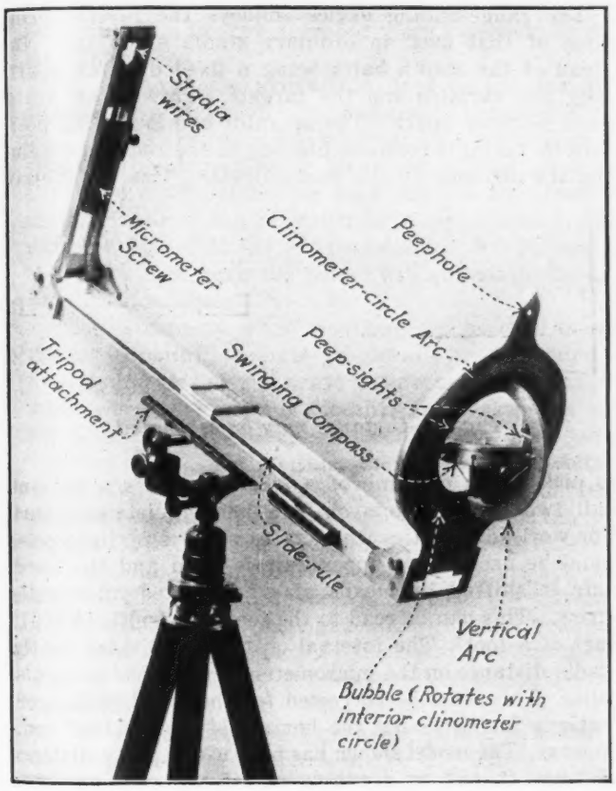


Fig. 1—Reconnoitregraph, mounted, ready for use
The instrument shown is the only one thus far made

prove a convenience in expediting preliminary surveys of such character as are usually required in reconnaissance work. It is especially well adapted for use in geological work, both underground and on the surface. It can be used for the following:

1. Compass surveying, in which the vertical angle and course are obtained in one orientation. Sights can be taken at any angle from vertically downward to vertically upward.
2. Taking strikes and dips in geological work.
3. As an outcrop tracer.
4. As a range finder or stadia.
5. As an open-sight alidade.
6. To solve the astronomical triangle graphically to determine the meridian.
7. As a hand level.
8. To determine accurately slight differences in elevation by obtaining the tangent of the angle by means of the movable stadia hair.
9. To measure angles to check up compass bearings.
10. Slide rule.
11. Graphical solution of the "three-point problem."
12. By virtue of its unique construction miscellaneous other problems can be solved by its use.

Fig. 1 shows the instrument mounted on a tripod. In this position it is ready for use in making compass surveys. It need not be mounted on a tripod except in certain operations.

Fig. 2 shows it in a folded position. It can be carried in a leather case similar to a slide-rule case, having one end slightly enlarged to accommodate the compass and clinometer part of the device.[1]

When it is desired to use the instrument for making compass surveys, the clinometer circle should stand in a vertical position so that the vertical arc is in a vertical plane. In sighting through the peep hole a glance at the bubbles will enable one to do this. The compass, by virtue of the weight at its base, will automatically seek the horizontal position and thus give the vertical angle directly. After the compass is read (there is a dampener provided to stop the oscillations of the compass), it can be clamped so that the vertical angle may be read at leisure. By referring to Fig. 1 and Fig. 2 it can be seen that the compass has a glass bottom. Because of this feature sights can be taken at any inclination. Because of the facility with which one can take these steeply inclined sights, the instrument should be found convenient in mine surveying, where it is often difficult by other methods to carry a line up a raise or down a winze.

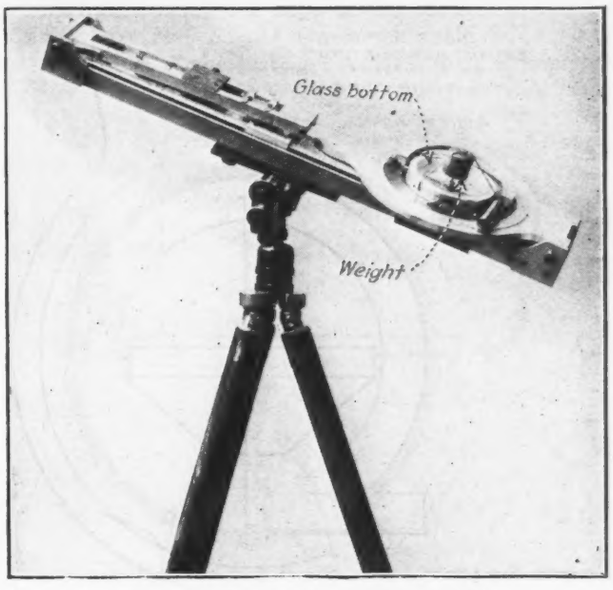


Fig. 2—Reconnoitregraph folded

[1]Several models of the instrument may be constructed. For mine work a model can be constructed with a base half the length of the present model shown in the photograph. (This has a base one foot long.) The front upright would fold over the rear upright, which contains the clinometer and compass part of the device, thereby making the instrument more compact and at the same time protect the compass.

In geological work the practice now is, when taking the strikes and dips of formations or veins, to obtain the strike with one orientation and the dip in another. By means of the reconnoitregraph both the strike and dip are accurately obtained with only one orientation.

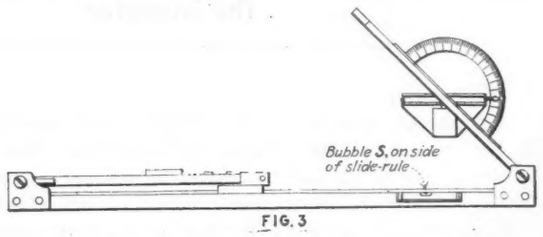


Fig. 3—Used for tracing outcrops

To do this the base of the instrument is used as a sighting plane. This is oriented so that it is parallel to the vein or formation whose strike and dip is to be determined. A glance at bubble *S* (See Fig. 4) will assist one in holding the slide rule level. The inner circle of the clinometer is rotated until the bubble *D* is horizontal. The angle rotated through is the dip. The compass will automatically seek the horizontal position and, by virtue of its mounting at right angles to the clinometer, will at once give the strike of the formation.

The new device should be useful in tracing outcrops of veins or formations. The outcrop in mountainous country, especially, is very sinuous, owing to the influence of the irregularities in topography. By orienting the instrument so that the base of the slide rule is parallel to the formation of vein to be traced, one can sight along it and see where the plane of the vein

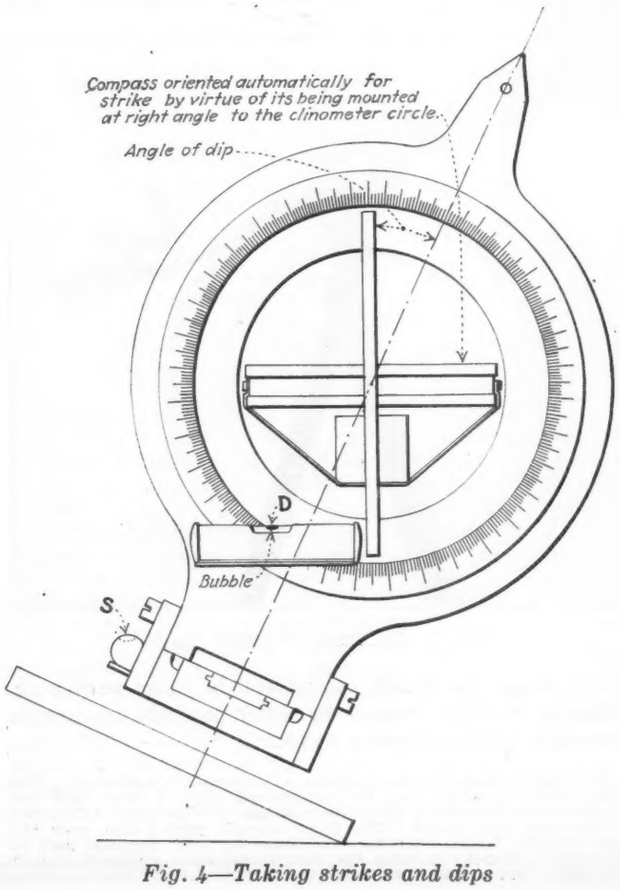

Compass oriented automatically for strike by virtue of its being mounted at right angle to the clinometer circle.
Angle of dip
Ø
D
Bubble
S

Fig. 4—Taking strikes and dips

projected (the base of the slide rule) intersects the topographic surface. This line of intersection is the line of outcrop. To do this it is advisable to mount the instrument on a tripod. If no tripod is available it can be rested on the knee or on a rock or any other object so as to hold it steady, and the clinometer circle (the rear upright of the instrument) folded as shown in Fig. 3 until the vertical angle equals the angle of dip. The instrument as a whole is rotated until the compass reads the direction of strike *plus 90 deg.* The plane of the clinometer circle is then parallel to the vein, and by sighting along the face of the clinometer circle one can see where its plane projected intersects the topographic surface, just as was done above, using the base of the slide rule.

The range-finding device employs the reverse principle of that used in ordinary stadia surveying. Instead of the stadia hairs being a fixed distance apart, they are variable and the targets sighted upon are a fixed distance apart. The operator can locate his position by taking a compass bearing to the rod and obtaining the distance by the stadia device. One has merely

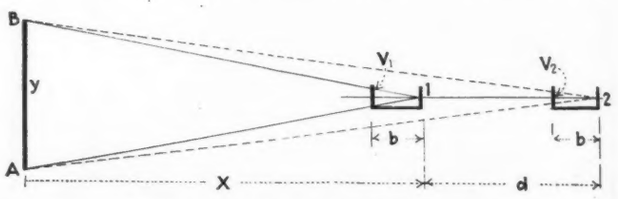


Fig. 5—Distance may be estimated

to pick up an old limb of a tree for use as a rod and nail two large targets on it a known distance apart. For work in localities where trees are scarce, light poles could be used. The upper hair is fixed and the lower hair is shifted by means of a graduated micrometer screw. This can be read to the ten-thousandth (0.0001) part of a foot. The interval on the rod divided by the stadia distance on the micrometer screw is the slope distance. This must be corrected for the usual stadia corrections for obtaining the horizontal and vertical components. The model shown has been used up to a distance of 1,000 ft. and an accuracy of 2-5 per cent has been obtained.

The degree of accuracy is dependent upon the keenness of vision of the person using the instrument. For certain classes of work it might be advisable to use the shifting stadia-hair principle within a telescope. By use of the telescope greater accuracy as well as distance could be obtained.

If it is desired to estimate the distance to some unknown point on which there is no rod with fixed targets, one can quickly determine this distance by measuring a short base line and taking two observations—one from each end of the base line. The base line, unlike that in use in triangulation, is roughly at right angles to the object instead of parallel. In Fig. 5 *A* and *B* are two prominent trees or other objects a fixed but unknown distance apart, *Y*. The observer is at point 1. The reconnoitregraph is rotated through 90 deg., so that the clinometer reads 90 deg. (that is, the slide rule is vertical and the two uprights are horizontal). The two stadia hairs are now vertical. An observation is now taken to *A* and *B* and the stadia hair distance V_1 determined. A short base line *D* is now measured off to point 2 and the second observation taken to de-

termine the stadia hair distance V_2. Whence it follows that:

$V_1 : y = b : x$ $\qquad$ $V_2 : y = b : (x + d)$

Therefore $y = \dfrac{V_1 x}{b}$ $\qquad$ by $= V_2 (x + d)$

Therefore, $y = \dfrac{V_2 (x + d)}{b}$

Substituting and equating:

$$V_1 x = V_2 (x + d)$$
$$V_1 x = V_2 x + V_2 d$$
$$V_1 x - V_2 x = d V_2$$

Therefore
$$x = \frac{d V_2}{V_1 - V_2}$$

It is evident that this is a much simpler formula to solve than the calculations involved in triangulation. This application of the reconnoitregraph should be especially usable to engineers, but more especially in military operations.

Fig. 6 shows the instrument used as an open-sight alidade. By virtue of the swinging compass the vertical angle is accurately obtained, regardless of whether the plane table is accurately leveled up or not. One edge of the slide-rule base has a scale graduated on it. To draw the direction lines an extension pencil can be attached to the slide-rule slide. By moving the slide back and forth the pencil will automatically draw the direction line.

The instrument, when mounted, can be used to solve the astronomical triangle graphically to determine the meridian. This should prove a convenience to engineers when working in strange localities, for they can readily determine the necessary declination to set off on their compass. To do this, the mounting attachment is carefully leveled up and the instrument depressed until the vertical arc equals the latitude of the place (Fig. 7). The line of sight and the parallel line through the center of the compass P-P^1 is the polar axis of the celestial sphere, and hence the upright C (clinometer circle) at right angles to the polar axis lies parallel to the plane of the equator. The declination at the time of observation is obtained from an astronomical almanac. This is set off on the vertical arc B by rotating the compass. This declination arc is measured from the plane of the clinometer upright C (90 deg. on the arc B) and it is either above or below, depending on whether the sun is above or below the equator (north or south). The small clamp on the vertical circle vernier must be used to hold the compass in this position. The compass is now in the plane of the sun's orbit. The observer now rotates the clinometer (the hour circle[2]) and the compass (with the declination set off on the vertical are B) until the line of sight across the top of the compass face, as indicated by the two small sights, points to the sun. The line of sight through the peep hole I will then be in the plane of the meridian. The clamp on the compass is released to permit the compass to seek the horizontal position. The compass is read and any deviation between the line of sight (which points north and south) and the compass reading is the declination. The magnetic deviation can now be set off on the compass, just as is done on the Brunton or other compasses, so that all magnetic readings subsequently taken are referred to the true north.

The instrument can also be used for hand leveling. If it is desired to determine slight difference in elevation more accurately than is possible by using the vertical arc, this can be done by leveling up the instrument and sighting through the peep hole to the object and shifting the movable stadia hair until it is in the line of sight. The base of the slide rule forms one side of a right triangle and the distance between the fixed and movable stadia hair the other, from which the tangent of the angle can be calculated to one minute of arc. Vertical angles can be obtained up to 5 deg. above or below the horizonal

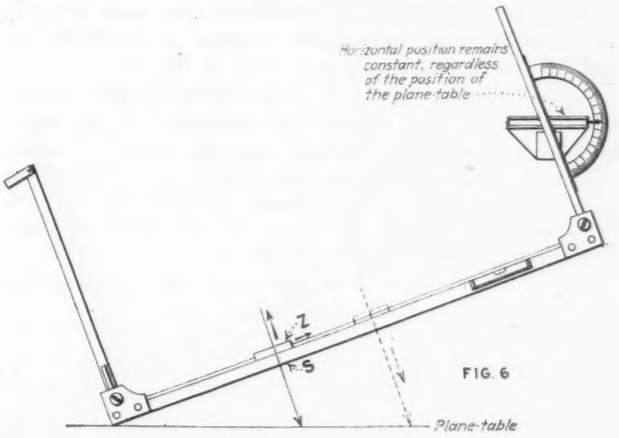


Fig. 6—Used as open-sight alidade

The reconnoitregraph can be mounted upon a miniature leveling head having a horizontal plate like a transit and can be used as a transit. It is possible to use the clinometer circle to measure horizontal angles within one-half degree. To do this the instrument must be mounted on a tripod and plunged so that the clinometer circle is horizontal. The line of sight is then taken along the edge of the vertical arc and the angles are read on the clinometer circle.

The base of the instrument has a slide rule mounted upon it. The slide rule should prove a great convenience in solving field computations.

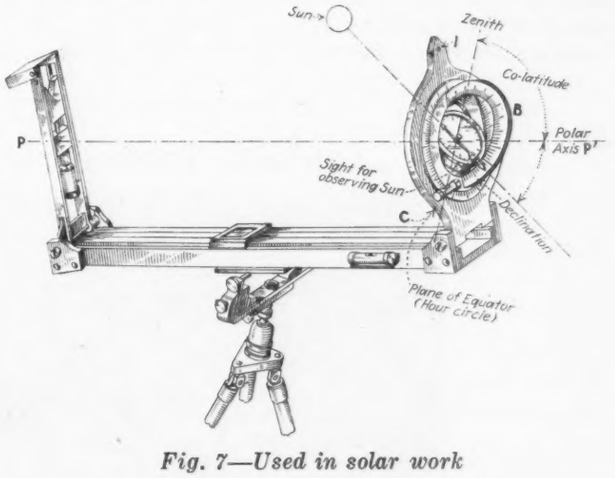


Fig. 7—Used in solar work

In addition to the above described usages, the instrument can be used to solve the three-point problem graphically. The base of the slide rule is used for sighting plane until the three points are simultaneously visible along the edge of the rule. The slide rule is then parallel to the vein. The inner clinometer circle is rotated until the bubble is horizontal. The angle is the dip. The compass reading is the strike.

[2]The clinometer circle is the hour circle when the various parts are thus oriented.

The Death of General Villa

By an Eye-Witness

AS THE BELLS from the church towers of Parral were tolling 8 o'clock, on Friday morning, July 20, 1923, the spectacular life of General Francisco Villa came to a spectacularly tragic end. The General and four of his armed body-guard, consisting of six men, were assassinated and the remaining two were severely wounded from an ambuscade planted in house No. 9, Calle Barrera, in the western part of the city.

At the time, the General, with Colonel Miguel Trillo, his right-hand man during his campaign in the latter part of the recent revolution, together with his body-guard of five, was driving into Parral in a Dodge car (Villa at the wheel with Colonel Trillo beside him on the front seat) from his house at the head of Calle Zarragosa, in the outskirts of the city.

The car came down Calle Zarragosa and passed along the east side of Plaza Juarez and was turning into Calle Barrera, the thoroughfare leading to the center of the city, when, in an instant, the double door of house No. 9, directly in front of the turning car, opened, and simultaneously, from the open door, came a crackling volley of rifle fire aimed point blank at the occupants of the car.

The surrounding hills returned the echoes, well remembered from the attacks on the city a few years before during the revolution, most of which were triumphantly led by Villa himself; but on this occasion these echoes were the phantom military salute for the dead General.

On the first volley, the car with its packed load, most of whom were now probably dead, swerved across the street, and ran against a small tree on the same side as house No. 9, but at a point about 40 ft. from it, toward the city, where it stopped, dead also.

At this moment six unknown men, with smoking rifles in their hands, emerged from the open door and rushed on the standing car, firing as they went. After firing a scattering volley into the car and its dead occupants, as a *golpe de gracia*, the assailants, their work done as planned, turned back and, at a brisk pace, passed along the north side of the plaza and, entering the street leading to the river-crossing at the westerly edge of town, disappeared.

It is estimated that there were in all from fifty to seventy-five shots fired by the attacking party, and probably a few pistol shots returned by the two wounded escaping body-guards—but none of the latter took effect. The body of the car was pierced by twenty bullet holes, but doubtless many more passed through the open space below the cover. The escape of the two guardsmen from the bullet-riddled car and their final escape alive down the fire-swept street are among those unaccountable mysteries that occasionally happen in similar occurrences.

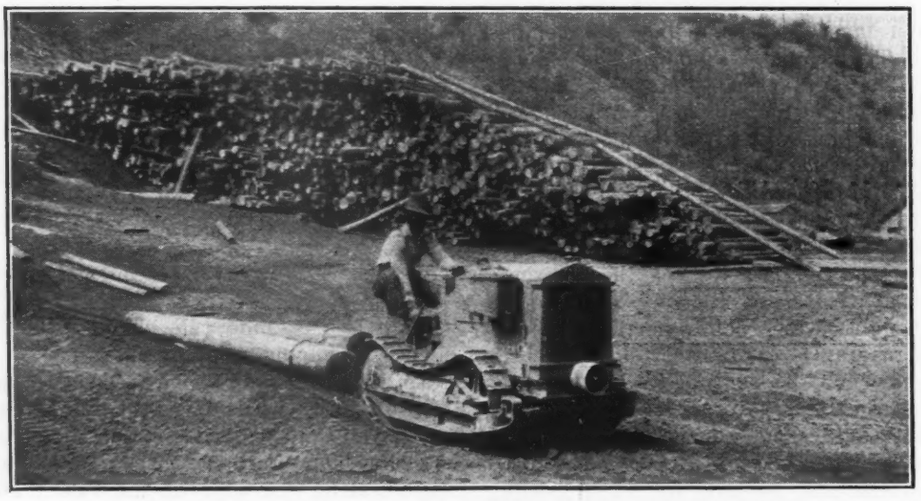
Immediately following the departure of the assailants, people began to gather around the scene of the assassination, where Death in all its frightful ugliness was revealed. Approaching the car from the south side of the street, the General's chauffeur, who had been riding on the running board, was lying on the street, face down, dead. Colonel Trillo was hanging backward, head down, over the door of the front seat, dead. Beside the Colonel, crumpled up on the seat behind the wheel, General Villa, torn with ghastly wounds, was sleeping his last sleep.

The bodies of the General and his Colonel beside him were literally riddled with bullet wounds. The post-mortem examination showed that sixteen bullets had passed through the General's head and body, and that eleven had passed through Colonel Trillo.

In the back seat, the only occupant left was dead, his rifle, the stock of which was bullet-splintered, lying beside him. Completing the list, the fifth member of the body-guard had crawled into an adjoining house, but died immediately afterward.

Thus the bodies of the dead—all silent, stark, still and ghastly, with blood still oozing from their gaping wounds and dripping to the street through the bottom of the car—were silently viewed by the crowds that gathered a few short minutes after the tragedy.

Caterpillar Tractors Are Useful in Mining Operations



A tractor at work in the Bunker Hill & Sullivan lumber yard

This vehicle has supplanted the use of horse teams in snaking timber from pile to mill. It does the work quickly and cheaply.

Educational Series, No. 1

Fundamentals of Amalgamation

A Review of the Practical Aspects of a Gold-recovery Process That Is Old But Still Important

By A. W. Allen
Assistant Editor, San Francisco

INQUIRY HAS BEEN MADE by many readers of the *Journal-Press*, in answer to a questionnaire, for simple, condensed but comprehensive information on mining and metallurgical practice, of instructional value to those who seek a broad outline of the subject, but who are not prepared to spend much time on reading or research. The following notes deal with a process—amalgamation—that has received scant attention on the part of investigators and engineers, but one that has played an important part in the history of metallurgy. It has survived as the bulwark for the continued success of the low-grade mine; its use is essential for the profitable exploitation of placer deposits, and it serves as a standby for the operator of the small property, whose aggregate contribution to the world's production of gold is considerable.

The word **amalgamation** implies a coalescence of substances. In mining practice it is used to denote the process by which a metal may be isolated from its ore as an amalgam with mercury. The action depends largely on surface-tension influences. Investigation has shown that in the gold-mercury series are three eutectics, and three compounds—Au_2Hg, Au_2Hg_5 and $AuHg_4$; the last mentioned decomposes into Au_2Hg_3 and mercury at its melting point. Gold and silver and platinum are the only metals from which economic recoveries by amalgamation are being made; but amalgams can be formed with many other metals, including aluminum, copper, iron, lead, tin, and zinc.

Mercury has a specific gravity of 13.59 at 0 deg. C., and an atomic weight of 200.6. It vaporizes easily, boils at about 360 deg. C. and freezes at —39 deg. C. It is purchased and transported in iron flasks or bottles, fitted with screw stoppers, which contain about 75 lb. of the metal. The Spanish flask contains 76.074 lb.

Amalgamation was known to the ancients. Vitruvius and Pliny refer to amalgams in their writings. Acosta described the process late in the sixteenth century. Barba, in the seventeenth century, discussed at length the treatment of silver ores thus, with especial reference to beneficiation practice at Potosí, Bolivia. With complex ore, the process relied largely on preliminary chemical reactions; iron and copper sulphates and salt were used even in olden times. The corrective mixture, or the copper sulphate, was known as *magistral* (from the Spanish word signifying oracular), which was credited with magic properties.

The patio process, so called because of the use of *patios*, or broad courts, for the weathering and decomposition of the mass, was evolved in Mexico about the middle of the sixteenth century. It was found applicable to a wide variety of silver ores. Fine crushing, as a preliminary, was practiced; salt, copper sulphate and mercury were the essential reagents; the treatment of the *torta*—the moist ore mass—occupied from ten days to a month, during which period the chemical reactions, followed by the amalgamation of the silver, were hastened by kneading, achieved by the treading of mules. The extraction of the amalgam by washing and the retorting of the mercury formed the final phases of the process. The patio process is still being used in isolated districts in Latin-American countries. In Peru, hyposulphite of soda in place of salt permits a quicker treatment of the mass.

Direct amalgamation of silver or gold in Mexico usually involved the use of an *arrastre* (from the Spanish *arrastrar*, to drag), which consisted essentially of a circular depression in the ground, lined at the sides and bottom with stones, on which two or more large boulders were dragged by means of mule-power applied to the extension of one of a number of horizontal cross-arms that revolved around a central and vertical axle.

The cazo process (from the Spanish *cazo*, a copper vessel) devised by Barba in Bolivia in the early years of the seventeenth century, was suitable for oxidized or native silver ores. The ground material was mixed with hot water, the temperature of which was maintained at boiling point, and salt, then mercury, were added. The silver chloride formed was reduced by the copper.

Barrel amalgamation is of historical interest. It was adopted in Europe late in the eighteenth century for the treatment of roasted silver ores. The first step in the process involved grinding in the presence of salt and iron; mercury was then added, and the amalgam was cleaned and retorted in the usual manner.

In the **Krohnke process,** devised to treat the complex silver ores of Copiapó and Antofagasta, Chile, wooden barrels were used. The essential chemical was cuprous chloride. The calomel formed was reduced by metallic zinc or lead.

The **Francke-Tina process** (from the Spanish *tina*, a vat), adopted extensively to treat the complex ores of Bolivia, involved the use of wooden pans with copper (or copper-alloy) mullers, shoes, and bottoms. Heat was essential, as with the cazo process, but steam was used. The ore, previously roasted, was added to salt water; the silver was amalgamated with mercury in the usual manner.

Amalgamation in iron pans originated at Washoe, Nev., in 1861. The Wheeler pan, considered as the standard, was of wood, with iron bottom, muller, shoes, and dies. The Boss pan, of the same general design, was steam jacketed.

The Washoe process was used to treat the amenable ores of the Comstock lode. Batch amalgamation was practiced in iron pans, the essential reagents, in addition to the iron, being salt and copper sulphate. A small amount of grinding was done in the pans, although these were ill-adapted for this purpose. After

amalgamation, the pulp and amalgam were discharged into a settler. Complex silver ores were roasted with salt prior to amalgamation treatment, the procedure being known as the Reese River process, which was similar to the Washoe process in subsequent operation.

Settlers used in conjunction with the older processes of pan amalgamation were usually of a size (8 to 10 ft. diameter) to take the pulp from two grinding pans. Revolving arms of adjustable height were provided, fitted with wooden shoes. The bottom of the settler sloped toward the sides, to facilitate the collection of amalgam. Holes, at different levels, were provided, and plugs were removed from these as required for the discharge of the tailing.

In the **Boss process,** the thickened pulp from a stamp mill or other type of pulverizer was reground and amalgamated in pans, and then passed to settlers. Amalgam was removed at intervals; otherwise the operation was continuous. The feasibility of a semi-continuous process of amalgamating is due to the fact that the metal is recovered almost directly from the solution, the reactions involved by the decomposition of the chloride by the iron, and the amalgamation of the deposited silver by the mercury, being almost simultaneous. The condition of the silver is such that amalgamation is highly efficient. No parallel condition exists in the amalgamation of gold in pans.

Tube-mill amalgamation of silver ore at Nipissing indicated exceptional practice under exceptional conditions. The process adopted was an intermittent one. A tube mill was used, the charge consisting of 6,500 lb. of ore carrying about 2,500 oz. silver per ton, with 8,500 lb. mercury, 3,800 lb. of 5 per cent cyanide (KCN) solution and 6 tons of pebbles. The extraction was reported to be 97 per cent.

Amalgamation of silver ores was practiced up to comparatively recent times, but it is now adopted only in exceptional cases, being confined almost entirely to those plants in which a gold-silver ore is being amalgamated. Wet-chemical and smelting methods, insuring higher extraction at lower costs, have replaced amalgamation for the recovery of silver.

The importance of amalgamation as a gold-recovery process at present may be gaged from the fact that about half the world's output is obtained by this method. Contrary to popular impression, the percentage recovery of gold on the Witwatersrand by the amalgamation process has remained almost stationary during the last decade, although the district's contribution to the world's supply has risen steadily from about 40 to over 50 per cent of the total. The prospect of increased complexity in the ores of the Far East Rand, however, indicates that future practice there may tend toward a relegation of the amalgamation process to a position of minor importance, consequent on the need for the finer comminution of the ore to expose the gold.

Concentration on corduroy mats, which are laid over the copper plates and are easily removable, has been adopted on the Witwatersrand. The mats are taken up and washed every four hours. The product is concentrated on a Wilfley table, the tailing being reground in a small tube mill and cyanided; the free gold is amalgamated in a barrel and recovered by customary methods. This innovation has resulted in a considerable reduction in the consumption of mercury in the plant, with no apparent diminution in the total percentage of gold recovered.

Amalgamation of low-grade gold ore involves comparatively fine crushing, which is expensive, and justified only when the recovery is almost complete, or when a part of the cost of grinding can be offset by subsequent recovery from the tailing by cyanidation.

With **high-grade, free-milling gold ore** there are advantages in amalgamation; but it would seem that a line of demarcation should be recognized at which amalgamation should be stopped and cyanidation begun; otherwise the residue may contain too much gold to lose but not enough to warrant the expense of secondary treatment. The net economic result of the treatment of an average or high-grade ore is usually better, and the net loss is usually lower, if amalgamation-cyanidation be adopted.

With **amalgamation** an **actual recovery of the metal** extracted from the ore is possible. Losses in treatment are mechanical and may be reduced to an insignificant minimum. The gold is recovered in its original purity without admixture with baser metals used in precipitation processes. The cost of amalgamation, *per se*, is low and the initial expense of equipment trifling when comparison is made with other processes. The technique is simple, the fundamental principles of practice are easily defined and the operation calls for no particularly skilled labor, no expert technical supervision or fine adjustment. Supplies needed are few in number and of regular standard. Special equipment is used rarely; patented practice is almost unknown.

Danger of theft has been overstressed in an attempt to deprecate the net value of the amalgamation process. This is illogical, for theft may occur whatever process is adopted. To prevent loss from such a cause it is necessary (1) to use care in the selection and in the retention of helpers, (2) to see that satisfactory relations exist between employer and employee, (3) to take precautions to minimize temptation. Plates are preferably housed in a room or building away from milling equipment; ample illumination should be provided at night; and, if practicable, plate rooms should be inclosed with coarse-wire screening. Other provisions against theft will depend on local conditions.

Complete treatment by amalgamation is now uncommon; practice at the Boundary Red mine, in Whatcom County, Wash., is a good example: The ore, containing finely divided free gold and a negligible amount of silver, is crushed and milled in a Blake breaker and a stamp battery. The pulp passes over two 5½x10-ft. amalgamation plates set at an inclination of ¾ in. to 1 ft., through an amalgam trap, and to a classifier. The coarse product goes to a Marathon mill fitted with an amalgamation head; the fine product joins the discharge from this and passes over amalgamation plates. The recovery of gold averages about 90 per cent.

Equipment for the amalgamation of gold in ore may be classed as gravitational or mechanical. In gravitational amalgamation the metallic particles come into contact with and are absorbed by the mercury by reason of specific gravity differences and surface-tension influences. In mechanical amalgamation these factors act in combination with a jigging, splashing, scouring, or grinding action designed to assist settlement or to freshen the surfaces of the metallics and to bring them into more intimate contact with the mercury.

Placer gold is recovered largely by amalgamation, although the process is not used by some operators who fail to appreciate the fact that losses may otherwise

occur. The use of mercury is not necessary if coarse gold only be present; but fine gold may pass through the plant undetected; hence the popular impression in some quarters that amalgamation is unnecessary.

Panning is used for the isolation of free gold in small amounts of gold-bearing material, or to estimate roughly its "value." The final product usually contains black sand or pyrite, in which case mercury is available to recover the free gold.

Rockers are used in the hand treatment of placer ground or similar material. They may be constructed according to a number of patterns, the fundamental idea being to assist concentration of the gold in the bottom of a trough, in which mercury is placed, by an intermittent motion that insures the elimination of gangue or other waste material. Rockers may be operated in series, connected so that motion applied to one of them may be transmitted to several.

The **sluice** is a trough or channel, usually of wood, placed at an inclination sufficient to induce rapid flow, into the head of which the gold-bearing material, often the result of hydraulic mining operations, is delivered. The bottom of the channel is provided with cobbles, riffles or block pavement; and mercury is used extensively in the first few sluice lengths to hold the gold as amalgam. The length of a sluice may vary from a few hundred to several thousand feet.

The **long tom** is essentially a small sluice, preceded by a compartment in which the gold-bearing material is mixed with water. A sloping perforated plate is placed between the mixing and distributing sections, to retain coarse material, which is discarded or returned to the head of the apparatus for more efficient pulping. Mercury is used, as in the ordinary sluice.

Gold-saving tables on dredges take the undersize from trommels. They are usually about 2 or 3 ft. wide, and equipped with riffles of various shapes and designs. Tail sluices provide additional opportunity for recovering gold. Mercury is used in all such equipment.

Metallic sheeting forms the most convenient material for the exposure of a large surface of mercury film to a fine-ore pulp carrying amalgamable metallics. The sheeting used may be copper or muntz metal. The latter is an alloy of 60 per cent copper and 40 per cent zinc; frequent dressing is desirable because the amalgam adheres less firmly than when copper plate is used; no general adoption of the substitute has been recorded. Copper, when used, should be pure and well annealed. The area provided varies from 1 to 10 sq.ft. per ton milled.

The **thickness of copper** used in an amalgamation plate varies with the severity of wear to which it is subjected. If considerable scouring action occurs, such as inside a mortar box, $\frac{1}{4}$-in. plate is customary. Apron plates are usually $\frac{1}{8}$ in. thick or thereabout. A heavier plate is generally unnecessary; a lighter one tends to bend easily or become dented, thus causing an uneven flow of pulp.

Amalgamation plates used in stamp batteries are:

1. Chuck-block plate, lining the chuck block, and inside the mortar box.
2. Back plate, also inside the mortar box, opposite the screen.
3. Splash plate, in front of the screen, and outside the mortar box.
4. Lip plate, attached to the lip of the mortar box.
5. Apron plates, adjoining the battery or placed elsewhere in the mill building.

Riffle chuck-block plates are sometimes provided with strips of $\frac{5}{8}$-in. flat iron, spaced $\frac{1}{4}$ in. apart, and laid horizontally. These are screwed into the block and rest on the plate; grooves are thus provided for the retention of amalgam, and a reduction in the abrasion of the plate is noticeable. In the Mother Lode district of California the copper plate is dispensed with, and horizontal square-steel rods are bolted to the chuck block to form a riffle.

Dimensions of copper amalgamation plates vary widely; local conditions, governed by general requirements and space available, usually decide the question.

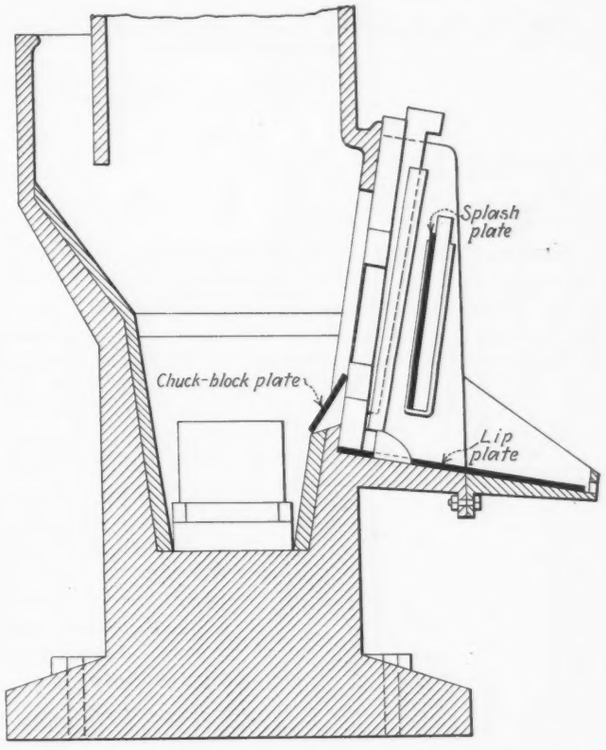


Fig. 1—Amalgamating plates in the Homestake type of mortar

Battery plates are made in all suitable sizes; apron plates are generally 4 ft., 4 ft. 6 in., or 5 ft. wide. A variation from normal practice is found at the Homestake mill, where the width is increased with each successive row. The dimensions are given in Table I, which is taken from the *Transactions* of the Institution of Mining and Metallurgy, Vol. 22.

The **advantage of inside battery amalgamation** is an open question, and the practice has been discarded in many instances in favor of lower screen discharge and higher tonnage output. Lip and splash plates have also been omitted in the adoption of a general scheme favoring simplicity of operation, especially where apron plates are placed at a distance from the battery.

Table I—Dimensions of Copper Apron Plates at Amicus Mill, Homestake Mining Co.

	Length, Ft.	Width, Ft.	Grades in In. per Ft.	Amalgam Recovered, Per Cent	Value Recovered, Per Cent
First row...	12	9	1.0	46.4	43.0
Second row	13.5	12	1.5	10.6	5.7
Third row..	12	13.5	1.5	5.6	3.1
Fourth row	12	15.75	1.5	3.1	1.7

Amalgamation is usually practiced after crushing or grinding, or in conjunction therewith. It is adopted to a considerable extent immediately after stamp milling. This is an efficient system, especially when gravity stamps are used. Instances have occurred in which steam stamps have been discarded on account of low subsequent amalgamation efficiency.

The **silvering of apron plates** is customary, but raw copper should be used for inside and lip plates. Silvered copper absorbs less gold and is easier to clean. The amount of silver used varies between 2 and 3 oz. per square foot of surface. The plating lasts from two to four years, or longer if especial care is taken during clean-up operations.

Table II—Amalgamation Results on a Sulpho-Telluride Gold Ore

	Bullion in Amalgam, Per Cent	Fineness of Bullion per 1,000 Parts		Total Value of Ore Milled, Per Cent
		Silver	Gold	
Battery amalgamation. Inside, without plates. Lip and splash plates. Apron plates	34	150	840	50.96
Apron plates after pan grinding of sands	39	150	840	6.31
Pan amalgamation of roasted concentrate	30	58	930	6.33

Shaking amalgamation plates may be set at an inclination of 2 in. to 1 ft., adjusted to a 1-in. stroke, with a frequency of 160 to 200 per minute. As an alternative, the apron plates may be connected directly with the mortar box, or battery foundation, to insure vibration. Other than where the ore contains a heavy gangue, it is usually found that the amalgam sets too hard. Mark L. Latham states that shaking plates are preferable to stationary plates if reground concentrate is being amalgamated.

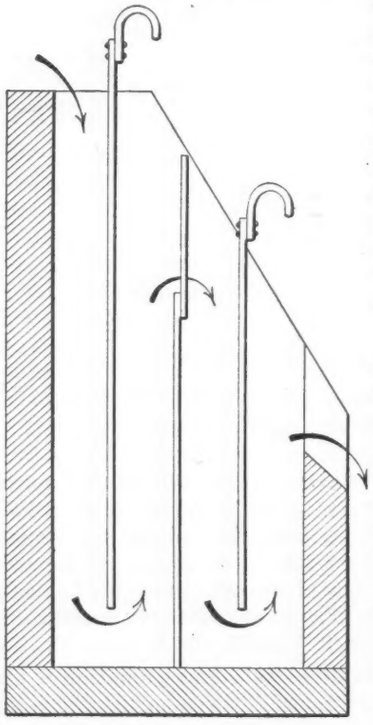


Fig. 2—Amalgam trap

Electrolytic amalgamation has been reported to give a high extraction of gold. One method of applying current for this purpose is to suspend graphite strips in the pulp stream just above the apron plate, connecting these and the plate to a low-voltage generator.

Grinding pans of improved design have been adopted largely as auxiliary amalgamators in the treatment of gold ore and concentrate. Various types are in use, usually 5 ft. or 8 ft. in diameter. The improved type of Wheeler pan, illustrated in Fig. 4, will handle sand, roasted concentrate, or roasted ore, save a considerable percentage of free gold, require little attention, and show only a small loss of mercury. In a few instances, none is added to the pan; but a concentrated product known as "pan bottoms" is removed periodically and treated with mercury in a small pan. The residue of this may be returned to the mill circuit.

Successful **pan-amalgamation practice** indicates the feasibility of the continuous grinding of ore and the continuous discharge of tailing, with intermittent recovery of amalgam. A 5-ft. pan, consuming about 8 hp. at 40 to 60 r.p.m., may grind about ten tons of ore or concentrate per day. The addition of cyanide is usually considered essential, and lime is necessary to agglomerate the finer particles of ore and to neutralize acid liberated during crushing. Mercury is added to the pan at the rate of about 1 lb. or so per day; consumption may amount to 0.1 to 0.2 oz. per ton milled. At clean-up times, usually at monthly or semi-monthly intervals, one pan is cut out of the circuit and run for a short period with solution or water, after which the amalgam and mercury is removed for cleansing and retorting.

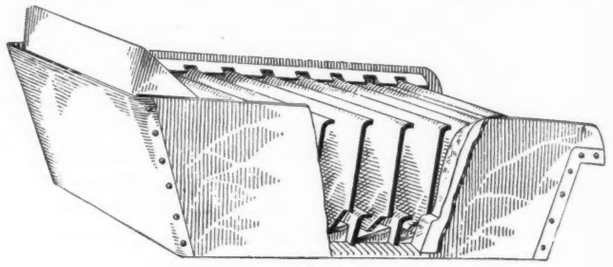


Fig. 3—Pierce amalgamator

No **continuous-recovery amalgamation process** is feasible with gold ore, whereby the amalgam is available as soon as formed or immediately after; but an extensive trial was made at the Hollinger mine, in Canada, on concentrate assaying from $350 to $400 per ton, obtained by the operation of Deister tables on an ore from which a high recovery of gold had previously been reported as practicable by the use of plates. The concentrate, according to account, "was shoveled into the grinding pans, which discharged into the settlers, from which a continuous stream of mercury flowed to the amalgam safes, being strained through canvas bags." The amount of mercury in the circuit amounted to about 1¼ tons. An expected clean-up of $40,000 resulted in a yield of $9.40, whereupon amalgamation was discarded.

An illustration of the results of **complex gold ore treatment** where amalgamation is practiced after stamp milling, regrinding of sand, and roasting of concentrate, is shown in Table II.

Ball or pebble mills are available as auxiliary amalgamators, but their use in this connection is not recommended. Mercury is fed at frequent intervals. A large proportion of the total amalgam will collect in the mill; the remainder is usually caught on apron plates.

Mercury or amalgam traps are seldom effective unless cleaned frequently. A common trpe, which may be of any desirable width, although used preferably in small-sized units, is shown in Fig. 2. The division plates, of iron or copper, are made to slide in grooves cut in the sides of the box, and are fitted with loops (for the outer plates) and rods (for the inner plates) to facilitate removal.

The Pierce amalgamator, often used as a trap to catch escaping mercury, is shown in Fig. 3. The pulp enters at *A* and leaves at *B*. The apparatus consists essentially of several divisions that deflect the pulp

against pools of mercury and amalgamated copper plates.

Cleaning up of byproducts, such as skimmings, mill sweepings and slag, is effected in a small grinding pan, in an amalgam barrel or in a Berdan pan. The grinding pan is usually a small type of one of the pans previously described. The amalgam barrel is a diminutive tube mill without trunnion openings. The type of Berdan pan used extensively in California (see Fig. 5) consists of a circular trough, set about 45 deg. off the vertical, and driven at about 20 r.p.m. by suitable gearing. Large steel balls, one or more, run in the lower part of the trough, thus assisting amalgamation and grinding the friable portion of the gangue until fine enough to overflow.

The gold in cyanide slag occurs free and in a form unrecoverable by amalgamation. The proportion of free gold varies according to the composition of the precipitate, the skill used in fluxing and the mechanical conditions obtainable during smelting and pouring. In some instances it is advisable to treat cyanide slag by amalgamation for the recovery of shot and prills, the residue being shipped to the smelter. As an alternative, the amalgamation treatment may be omitted.

The **preparation of raw copper plates** for amalgamation involves particular care and tedious labor. Polished copper when exposed to the air tarnishes rapidly, and the fact must be recognized that mercury can be made to amalgamate effectively a copper surface only when the latter is clean. The exact method of procedure differs, but the fundamentals are as follows: The plate is first cleaned with a strong alkali solution to remove grease, then washed with water and scrubbed with fine sand until bright. Burnishing is not attempted at this stage, but the surface of the plate is softened by treatment with potassium or sodium cyanide. It is preferable to paint this on as a saturated solution and leave to dry overnight. Next morning the plate is washed thoroughly, then scrubbed with fine sand and finally burnished with wood ashes. Undue exposure of the polished copper to the air must be avoided. The plate is again washed, sprinkled with mercury, moistened with dilute cyanide solution and amalgamated by vigorous rubbing. This is continued for several hours, the copper being kept under running water when the work is interrupted. If a green spot appears on the surface, this must be rubbed clean to the copper and the plate reamalgamated at that place. Daily rubbing should be continued for three or four days, after which the plate is given a coating of thin amalgam. It is then ready for service. Silver-plated copper plates may be prepared in a short time by being rubbed with mercury after having been cleaned with alkali to remove grease and with fine ashes to remove tarnish.

Where **amalgamation** is effected **inside crushing machinery** it is necessary to add mercury periodically with the feed, in amount usually equivalent to 1 or 2 oz. per ounce of gold to be recovered. Chuck-block, inside-liner, lip and splash plates are dressed only after cleaning up. Apron plates may be "rubbed up" as frequently as twice an hour, and are dressed frequently. By dressing is meant the removal of excess amalgam and the burnishing of the plate with fresh mercury.

The **interval of time between dressings** should be based on actual data of maximum total amalgamation recovery and minimum time spent in table dressing to obtain it. In many instances it has been found that the time interval between dressings can be extended with advantage. Two men can dress an average-sized apron plate in five to fifteen minutes; the frequency of the operation varies from once per hour to once per day.

The **amount of mercury required** is determined by the appearance of the plates and the grade of the ore being milled. Soft amalgam may result in "tears" of mercury being formed on the surface; these if washed off may carry gold with them. The loss of mercury in a wet-crushing mill may vary from 1/20 to 1 oz. per ton milled; the average on the Witwatersrand is $\frac{1}{10}$ of an ounce.

The **inclination of amalgamating plates** depends on several factors, chief of which are the coarseness of

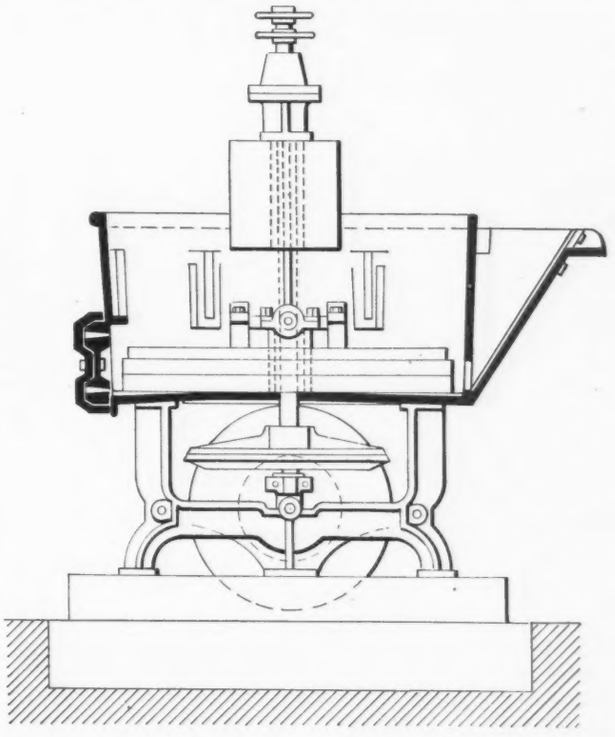


Fig. 4—Improved Wheeler grinding-amalgamating pan

the ore and the degree of dilution of the pulp. With ordinary battery practice a fall of from 1 to 2 in. per foot is usual.

Degree of **pulp dilution** is often regulated by battery or mill practice previous to amalgamation. Sufficient diluent must be allowed to prevent banking of sand on the surface of the plate, but insufficient to facilitate the washing away of amalgamable gold. The wave motion of a stamp-mill discharge is a potent factor in effective amalgamation, but this can be duplicated by an automatic device.

Amalgamation in cyanide solution involves a loss of mercury, which is dissolved in the cyanide. Corrosion of the copper occurs if plates are allowed to become too bare. Short apron plates are generally used. The amalgam hardens, but the cyanide aids in keeping it in good condition.

Mercury may become sickened from a number of causes, chiefly because of admixture with base metals or grease. Cleansing may be effected by the use of cyanide (of potassium or sodium), sodium, or other

chemicals, or the mercury may be retorted, or treated with dilute acid. The flouring of mercury usually connotes sickening, although it may arise solely because of excessive agitation and over-grinding.

Details of **dressing practice** vary with individual millmen. The fundamentals involve cleaning the plate with water, brushing the excess amalgam toward the head of the table with a rubber scraper and removing it with a small scoop. The surface of the plate is next worked up and burnished, with the addition of fresh mercury.

Wet amalgamation is a phrase applied where care is taken to keep the amalgam in a soft condition by

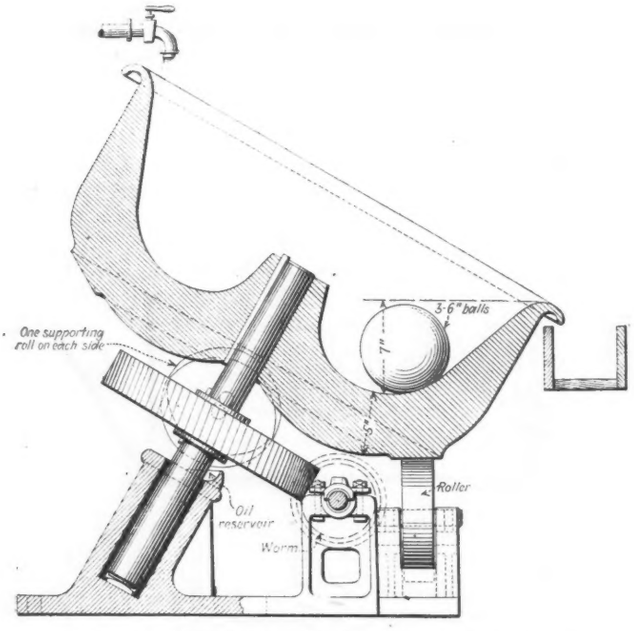


Fig. 5—Type of Berdan pan used extensively in California

considerable "working up" at each dressing. Dry amalgamation, on the other hand, indicates that the amalgam is allowed to harden, and chipping or other means must be adopted for removal at clean-up.

In the **daily cleaning of amalgam** the addition of excess clean mercury is advised. The mixture may then be ground in a Wedgwood mortar or in a Berdan pan. Scum is taken off as it rises to the surface and a magnet is used to remove iron or steel. The thin amalgam is then transferred to a second receptacle over which an amalgam cloth has been placed, the ends of the cloth are picked up and twisted together, and the excess mercury is expelled by squeezing by hand, or by means of an amalgam press. The ball or lump of amalgam is then ready for weighing.

The **cleaning up of plates** is done usually at monthly or semi-monthly intervals; the operation consists of chiseling or scraping the surface to remove the amalgam. Scrapers used for removing amalgam from copper plates are usually made from discarded flat files, which have been heated and bent at right angles near the end, and ground to form a chisel edge. "Sweating" is sometimes practiced to loosen the deposit and permit a closer clean-up to be made without the possibility of accidental removal of copper or silver from the plate. In this operation the plate is boxed and packed so that the surface alone is exposed to the steam. Vaporization of the mercury occurs, which involves danger to operators from salivation. The amalgam recovered is cleaned with excess mercury in the usual way. After the removal of the deposit by either method the surface of the plate is again burnished with mercury and is ready for further use.

The **retorting of amalgam,** to which may be added a small amount of nitre to insure preliminary refining, is performed in a cast-iron chamber or other conveniently shaped receptacle, fitted with a door that can be securely held by screw or wedge. An outlet pipe connected with the retort passes through a condenser that is cooled by running water. The amalgam is placed in the retort, the door is luted with clay or fitted with asbestos packing and tightly closed, and a fire is started underneath. The mercury vapor condenses in the outlet pipe, and the metal is delivered under water into an amalgam bucket. Ample time should be allowed after an apparent cessation in the flow of mercury, to permit residual traces to be vaporized.

The **smelting of retorted metal** is practiced in a carefully annealed plumbago crucible, a small percentage of borax being usually added as a flux. Refining methods on retorted gold are seldom necessary. The molten metal is poured into a warm, oiled mold, or into one the interior of which has been coated with soot by being inverted over a smoky flame. When set, the bar may be plunged into dilute acid and afterward burnished by being scrubbed with a wire brush and a solution of carbonate of soda.

Scaling of old amalgamation plates may be effected by coating the surface of the plate with a thin layer of a mixture of sulphur and powdered salammoniac. The plate is then evenly heated underneath. When cool, the scales can be removed easily; these can then be treated with nitric acid to remove excess copper, and afterward smelted in the ordinary way. Plates scaled by heat methods are invariably damaged beyond repair unless unusual shop equipment is available.

Salivation or mercurial poisoning follows the inhalation of mercury vapor and may occur after "sweating" the plates with steam, or as the result of accident to the retort, or by withdrawing the retorted metal too soon. The poisoning results in loosening and ultimate loss of teeth, with soreness of the gums and tongue. The immediate antidotes are milk, white of egg, and flour and water.

Metal Mining in Montana Improved in First Half of 1923

The mining industry of Montana showed a decided improvement the first six months of 1923, according to a statement based on statistics compiled by C. N. Gerry, of the U. S. Geological Survey. The electrolytic zinc plant near Great Falls was being operated at capacity, and the copper plant at Anaconda was treating ore and concentrate at a rate far in excess of that in 1922. The increase in the prices of copper, lead, and zinc in the early months of the year stimulated mining at Butte and other districts of the state, and labor conditions have been better than at any time in the last few years.

The Great Falls electrolytic zinc plant is now drawing concentrates and ores from the Coeur d'Alenes. The copper mines of the state are having difficulty meeting expenses in the present market, and recently the North Butte shut down its mine.

Sampling Custom Ores

Practice at the Tom Reed Mill, at Oatman, Arizona, Gets Away from the Usual "Bullion Plus Tails" Estimation

By W. A. Linfesty
Mill Superintendent, Tom Reed Gold Mines Co.

THE use of custom milling in the Oatman district early in 1922 was brought about primarily by the reduction of tonnage output from mine to mill at the Tom Reed gold mine, to about one-half capacity. Owing to curtailed output from the mine, only part-time operation of the crushing, coarse, and fine-grinding departments was possible in the mill, while an effort was made for continuous operation of the cyanide plant. These conditions led to negotiations to treat the ores of two promising prospects, each of which had considerable commercial ore developed and on the dumps. The managements of these properties were glad to avail themselves of the opportunities thus offered and agreed to deliver a definite tonnage to the Tom Reed mill daily.

Investigation proved that there was insufficient custom ore available in the district at that time to warrant the installation of an automatic sampling plant, while conditions in the mill (available head room, and other operating factors) were such that the use of such samplers as the Snyder, Vezin, Higham, and others, placed to sample any of the pulp streams, was impracticable. Sampling the ore at any point between the crusher plant and the point of introduction for primary grinding was considered dangerous.

Arrangement of Regular Flow to Handle Custom Ores

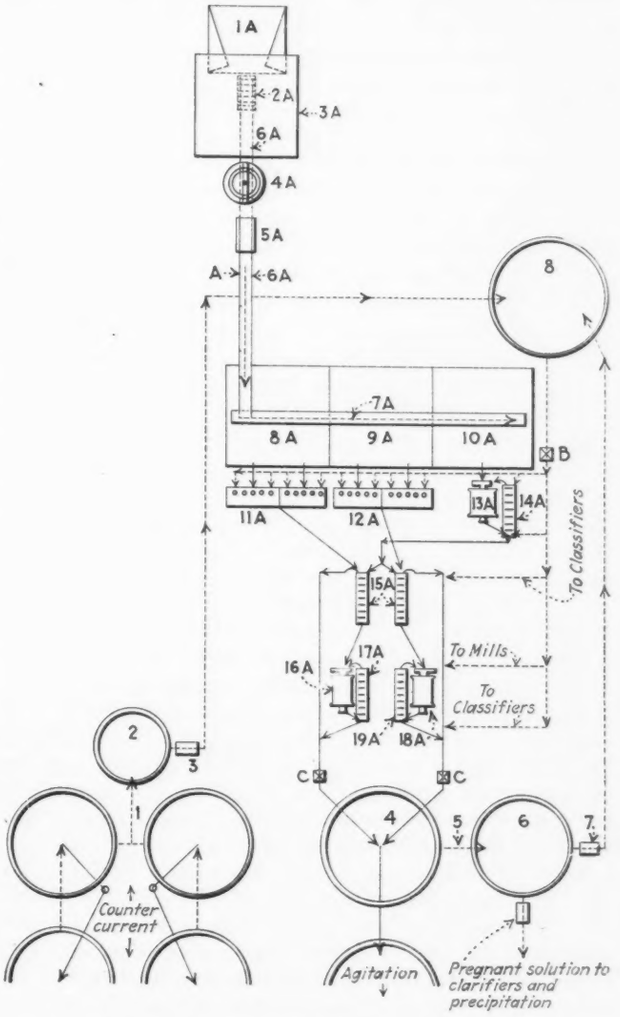
To digress: In 1917, when the Tom Reed mill was remodeled, a No. 6 gyratory crusher (4A) was added to the crushing equipment, and a Dodge type crusher (2A) was retained, lower down over the conveyor belt (6A), to serve as an auxiliary whenever the gyratory crusher might be undergoing repairs. In the mill a 6x5-ft. ball mill (13A) was installed, replacing a twenty-stamp battery (11A and 12A), for primary work.

Two 5x6-ft. ball mills (16A and 18A) replaced two pebble mills for regrinding. The pebble mills were discarded entirely, but the stamp battery was retained to serve as auxiliary to the primary ball mill when that unit might be undergoing repairs, relining or other attention. The coarse- and fine-grinding departments then consisted of a primary ball mill or twenty stamps serving two regrinding ball mills.

Resuming, the ore bin (1A) and Dodge crusher (2A) were given over to handle custom ores exclusively. A weightometer (5A) was installed on the conveyor. Divisions were placed in the mill storage bin, forming three bin compartments (8A, 9A and 10A), as shown in the flow sheet. This arrangement prevents mixing of shippers' and company ores, each of the shippers' ores being stored back of a ten-stamp battery, and company ore back of the primary ball mill.

With this arrangement a battery of ten stamps and one regrinding mill is devoted to each shipper, while the primary ball mill and two regrinding mills handle company ore. Custom milling is carried on during the day shift and when necessary a part of the afternoon shift, with the remainder of the mill day available for milling company ore.

Intermediate classifier overflow and finished product



Partial flowsheet of the Tom Reed mill

from each of the regrinding mills was introduced into the primary thickener through two separate launders, keeping the two lots of custom ore as milled separated until introduction into the cyanide plant.

Originally, counter-current overflow (1) and a part of the primary thickener overflow (5) solutions were introduced into the mill circuit at two different points. These were combined by piping the two into one common storage tank (8).

The different steps in the daily sampling of custom ores, with explanation thereof, were:

Moisture content of the ores throughout the district

is fairly uniform. A grab sample taken at *A* at regular intervals serves nicely for moisture determination.

A steady drip solution sampler was placed at *B* on the mill solution supply line. This solution is a combination of the entire counter-current overflow (1) and a part of the primary thickener overflow (5), and is discharged, after storage in the mill solution tank (8), at the several coarse- and fine-grinding units for milling purposes and at the classifiers to maintain the dilutions necessary for proper classification.

The drip sample is taken continuously during the entire period of custom-mill operation, after which the sample is prepared for assay. This item is important, as the value in solution, before contact with custom ore, should be known. This sample will be referred to as "mill solution."

Half-hourly samples of the pulp stream (ore in contact with the above-named solution) are taken from the launders, at *C*, carrying the finished product to the cyanide plant. These sample cuts are carefully taken from the full stream, avoiding splash or spill, and deposited in air-tight containers. It will be noted that this sample is taken after regrinding has been completed and just prior to cyanidation, so that the maximum of ore mixture and reduction has occurred before sampling. Average grinding percentages are:

	Per Cent
Plus 100 mesh	1.00
Plus 150 mesh	4.00
Plus 200 mesh	10.00
Minus 200 mesh	85.00
	100.00

A description of the preparation of this pulp sample follows: The entire sample is charged into an agitator of the Pachuca type and thoroughly mixed. The Pachuca was made especially for this purpose, and is equipped with an air manifold to prevent "settling out" in the cone, and an air lift for rotation.

When the mixture is complete, samples are drawn off and prepared for assay. These samples are placed in a pressure filter, the solution filtered and caught in a large sample bottle. This sample will be referred to hereafter as "pulp solution." After filtration is complete the pulp remaining on the filter leaf is given a water wash, dried, and retained for assay. This sample will be referred to below as "washed pulp."

Further samples are drawn from the Pachuca for specific gravity determination—i.e., the ratio by weight of solution to one of dry slime (ore) is determined, and later recorded on the daily assay report. This item is important, as the tonnage of "mill solution" in contact with custom ores is calculated from the ratio. In connection with this item the evaporation method is also used to determine the ratio, and is used as a check.

A reliable solution meter installed on the mill-solution supply line at some point between the storage tank and the first discharge outlet to mills or classifiers would eliminate the necessity of finding the ratio and simplify the recovery calculation as well.

The recovery calculation reduced to simple arithmetic, as shown below, is taken from the record of one day's operation on Tom Reed ore during the preliminary experimental test rather than from a day's operation on custom ores.

Needless to say, the item of solution tailing is not deducted, and the item "net value ore" shown above becomes net recovery in calculating for custom ores.

Calculation of Recovery

135 Tons Ore Milled
540 Tons Solution Precipitated

Assay Report

$$\text{Solution ratio} = \frac{\text{Moisture, 87.67 per cent}}{\text{Solids, 12.33 per cent}}$$

Sample	Oz. Au	Value Au
Mill solution	0.135	2.78
Pulp solution	0.150	3.10
Washed pulp	0.420	8.68
Ore tailing	0.02	0.42
Solution tailing	0.001	0.02

$$\frac{87.67}{12.33} = 7.1103 \text{ solution ratio} \quad \ldots\ldots(1)$$

$$\left.\begin{aligned} 7.1103 \times 135 &= 959.8905 \text{ tons of mill solution} \\ 959.8905 \times 2.78 &= \$2{,}668.49559 \text{ value of mill solution} \end{aligned}\right\} \ldots(2)$$

	7.1103	ratio
	× 3.10	assay pulp sol.
	22.04193	sol. value per ton ore
Plus	8.68	assay washed pulp
	30.72193	per ton value sol. and ore
	× 135	tons ore
	4147.46055	total value
Less	2668.49559	value mill sol.
	1478.96496	gross value ore milled
Less	56.70	ore tailing @ 42c.
	1422.26496	net value ore milled
Less	10.80	solution tailing @ 2c.
	1411.46496	net recovery

$\ldots\ldots(3)$

$$\text{Then:} \quad \frac{\text{Gross value ore}}{\text{Tons ore milled}} = \text{ore head,}$$

$$\text{or,} \quad \frac{1478.96496}{135} = 10.95529 \quad \ldots\ldots(4)$$

Or a short-cut method by which the ore head can be quickly figured:

1		2	
	3.10	assay pulp solution	7.1103 ratio
Less	2.78	assay mill solution	× .32 difference
	.32	difference	
			2.275296
		Plus 8.68	assay washed pulp
			10.955296 ore head

This method of sampling was first tested out experimentally, over a fifteen-day period during regular mill operation on Tom Reed ore, in parallel with the regular (bullion plus tailing) method of recovery calculation, the bullion "clean-up" for that period being the check. Experimental results checked the bullion return within 3 per cent, although the weightometer (5A) was not then operating, necessitating daily estimates of the ore tonnage milled. Any error in estimating the ore tonnage would be reflected in the "mill-solution" tonnage.

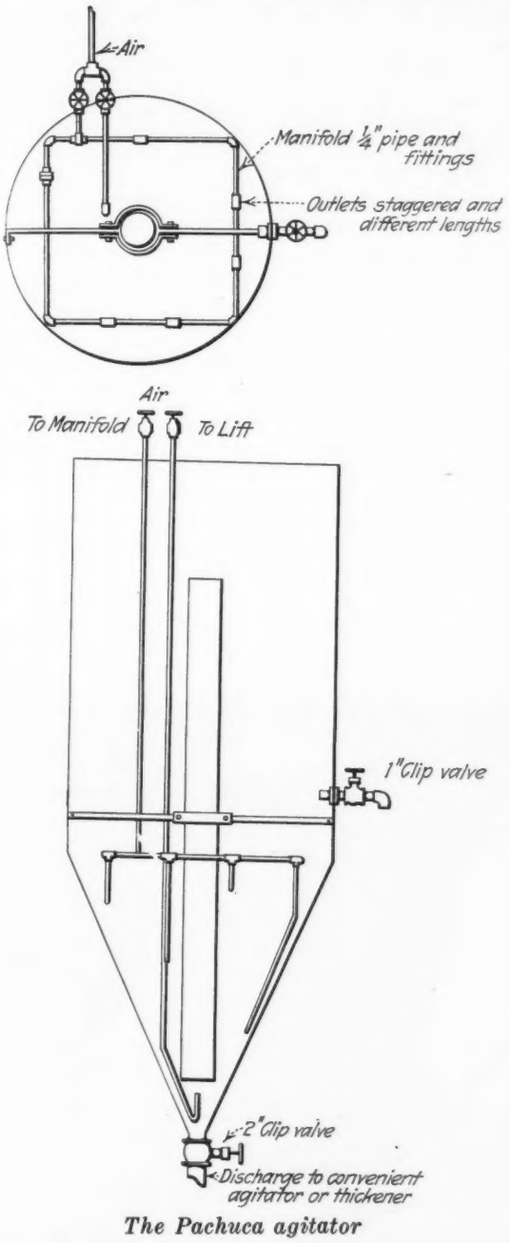
More than a year's experience in using this method has demonstrated that after the sampling routine is established the possibility of error is no greater than that of other established methods. Possibly a little more time is required in making the calculation than is required by other methods, but this may be offset by the advantage of determining daily the true head, as is not the case if the bullion plus tailing method is used.

Present vs. Older Methods

Heretofore my sampling experience has been confined to two methods: that of taking cuts of the ore at the battery or primary mill feeders at regular intervals and tagging the result "head sample"—and to the bullion plus tailing method. Results obtained from the former usually do everything but check the bullion output, whereas the latter does check the bullion return where the general mill practice is good.

The criticism, however, most often heard concerning bullion plus tailing is that it does not give the true ore head for each day's operation, and that this some-

times results in poor co-operation between mine and mill. This possibly is true, as the solution from decantation or filtration (the greater portion of "mill solution") is returned to the mill circuit several days later, according to required time of contact, than the day upon which the calculation was made and the ore head reported. In other words, the method is one of



The Pachuca agitator

indirect sampling, and at least a month's operation is required to obtain a calculated ore head, which then is only an average for that period.

It is not intended to advocate the improvised method described herein as a substitute for any other method of sampling, but it is hoped there may be some items that will be of interest to the cyanide millman or metallurgist.

Later, increasing activity in the district warranted the erection of a sampling plant, and recently an automatic sampler was installed at the head of the mill. The sampling plant consisted of the following equipment, in order of flow:

One 60-in. Snyder sampler taking a 10 per cent cut of 2-in. material and smaller at the conveyor discharge.

One 15x9-in. Blake crusher provided with special eccentric to crush from 2 in. to ½ in. at about five tons per hour.

One 27-in. Snyder sampler taking a 10 per cent cut of ½-in. material.

One set 18x10-in. crushing rolls with capacity of 1,000 lb. per hour from ½-in. material to $\frac{3}{16}$-in. product.

One 27-in. Snyder sampler arranged to take a 10 per cent cut of $\frac{3}{16}$-in. material.

One sample grinder reducing 100 lb. per hour from $\frac{3}{16}$-in. product to 40 mesh.

One 27-in. Snyder sampler taking a 10 per cent cut of 40-mesh product.

One 6-in. mill elevator.

All driven from one 25-hp. motor.

Jones dividers and Braun pulverizers are used for further splitting and reduction.

Trench Hats Find Peace-time Use Underground

The trench hat, the "old tin hat" that served in some measure to turn shrapnel hail on the war-swept fields of France, is coming into quite extensive use as a means of head protection against falls of rock and ore in the mines of California, West Virginia, Oklahoma and many other states, according to R. V. Ageton, of the Bureau of Mines. The hats are being used in shaft sinking and in raising operations and around and in hoisting shafts, states Mr. Ageton. The "trench shoe" and similar heavy shoes are also being utilized by miners as a medium of foot protection.

The Cornish miner of earlier days, who has left his mark in nearly every metal mining camp of the United States, usually protected his head with a hard resined felt hat, on which was stuck a candle, the candle being held in place by a gob of mud. The hat was hot, heavy, and cumbersome, but long years of mining experience had impressed on the Cornishman the wisdom of protecting his head from bits of falling rock. His heavy, cumbersome, cowhide boots, with soles half an inch to an inch thick, undoubtedly prevented many an accident to his feet.

Stiff protective hats are still widely used in some mining districts, but in general the custom of wearing stiff hats is not nearly so common in mines of this country as it should be, probably because a large proportion of the foreign-born miners, as well as many American-born miners, now come to the mines from other occupations, without previous knowledge of mining, and do not appreciate the importance of protecting the head and feet from minor accidents. In recent years, however, the Bureau of Mines has noted a gratifying increase in the use of protective devices for the head by the miners of this country. Many of the soldiers had been miners, and came back with a wholesome respect for the trench helmet and the trench shoe. After being discharged, numbers returned to the mines, and brought with them the trench hat and the thick trench shoes. As one miner in an Oklahoma zinc mine expressed it, "If the old tin hat would stop shrapnel, I reckon it'll stop these small pieces of jack."

Both miners and operators have been quick to recognize the advantages of these war-time devices for mining use, and at least one mining company was so impressed that it bought a large quantity of trench hats and distributed them to its employees.

The Canterbury Tunnel

A Project to Stimulate Mining in Leadville

By Felix Edgar Wormser

Portal of the tunnel
which runs southeasterly for 1,970

IN NEARLY every mining district men may be found who have spent the better part of their lives working in or operating local mining properties. Close association with the development of their particular district generally gives them a familiarity with it that causes them to reside in the camp long after their associates have moved to what they considered fairer fields. Leadville has many such residents. They have lived through periods during which the output of a few square miles of Colorado mountain land have yielded fabulous riches in gold, silver, lead, and zinc. They have also watched the production of the district decline and the population of Leadville fall off. They have steadfastly refused to be dismayed by the readiness of others to abandon the search for ore and have continued with their work, confident that the district which they know so well contains ore for those who will keep up a diligent hunt.

Such men are behind a project in Leadville which has possibilities of rejuvenating the camp. This enterprise will prospect, by means of a long tunnel—the Canterbury tunnel—a section that has never been thoroughly explored, but which is geologically favorable for the location of ore deposits. Jesse F. McDonald, ex-Governor of the state, manager of the Downtown Mines, who has spent a long time in Leadville, is president; John Cortellini, a successful Leadville mine operator, is manager; Joseph W. Clarke, an attorney of long residence in Leadville is secretary; and the treasurer, W. M. Harvey, is manager of a local hardware company. A company has been formed called the Leadville Mine Development Co., with a low capitalization, $150,000, to drive a long tunnel S. 60 deg. 47 min. E. in the west slope of Canterbury Hill and Prospect Mountain—a part of the district that has received scant attention in the past—lying a little less than two miles in a northeasterly direction from the railroad depot. The people of Leadville through the Chamber of Commerce have had a choice in the selection of company officers and in the location of the tunnel. Practically all the mining land developed by this project has been leased or bought by the company, which has driven the tunnel for 1,970 ft.

Late in May of this year a water-course was struck, temporarily preventing progress. The initial flow was close to 10,000 gal. per minute, which subsided to about 2,500 gal. per minute. At the end of June, when the accompanying photograph was taken, a torrent of water still issued from the face. The Canterbury tunnel will likely ease the pumping load in other parts of Leadville, an important item in the cost of mining in the district.

The tunnel—5x7ft. in the clear—has had to be timbered for nearly all its length. Tunneling has been done under contract. A modern ten-drill electric compressor furnishes air for the machine drills. Considering the conditions under which the work has been advanced, the cost of the tunnel has been low—$18.70 per ft., timbered and ready for traffic.

The Canterbury tunnel is in wash for 900 ft. from the portal, in which distance heavy timbering and spiling were necessary—also the raising of two air shafts for ventilation. For the next 400 ft. the tunnel cuts shales, porphyry, and limestone and then intercepts a fault, beyond which more porphyry and limestone were found. At a point 1,437 ft. from the portal, a crosscut 50 ft. long was driven to connect with the bottom of Roseville No. 2 shaft, which was known to lie near the line of the Canterbury tunnel. The shaft was so completely caved, however, that it was decided not to get at the old workings through it. The tunnel was thereupon continued through 150 ft. of hard limestone and porphyry and a raise driven to establish a connection with a drift from the Roseville No. 1 mine shaft. Indications of ore were found, but, owing to the close proximity of the drift to the wash, development was not considered advisable. The tunnel was then continued to its present extent. It is now held to be entering Canterbury Hill proper, where a few prospects were worked many years ago, but whose development was retarded by the great amounts of water encountered which made mining too costly.

Whether the Canterbury tunnel project will achieve its object of opening up a new mining area in Leadville

Why mining in Leadville is hampered
This water-course was struck in the Canterbury tunnel face

will not be known for several months. It deserves to be successful, for seldom has an enterprise of this nature been handled so wisely and conservatively. The prospectus of the company has confined itself to a recital of facts and the venture has not been surrounded by the stock-jobbery so often associated with mining promotion. Should the company be successful—and even if it isn't—this interesting example of co-operative mining may point the way for other communities that know the possibilities for developing mines in their localities.

Section of company's property showing where ground has been removed for large-scale test in mill

Diamond Deposits in Arkansas

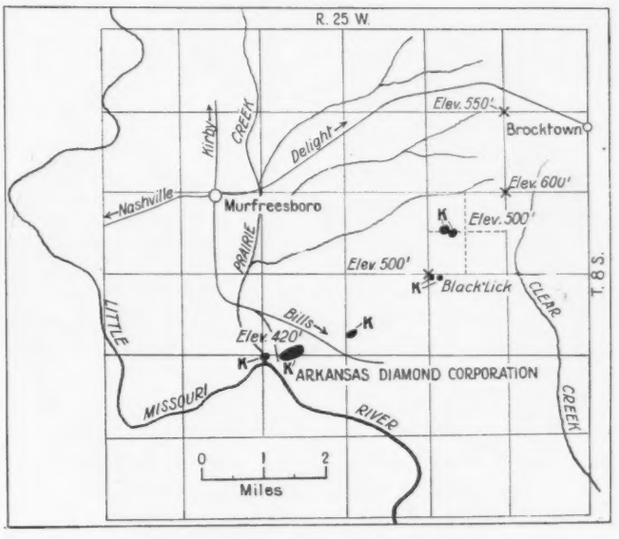
A Recent Geological Study of a Property Near Murfreesboro, the Commercial Importance of Which Is Being Tested

By Graham John Mitchell
Chief Geologist, Cananea Consolidated Copper Co.

THOUGH the presence of peridotite in Pike County, Ark., had been known for years and the possibility that it might be diamond bearing was suggested in the early 80's by Dr. John C. Branner—to whom also must go the credit for first determining the rock to be peridotite—it was not until the actual discovery of two of the precious stones in 1906 that any unusual interest was aroused by the occurrence. The first diamonds in Arkansas were found by J. W. Huddleston on his farm near Murfreesboro. An option was taken on the property by Samuel W. Reyburn, Charles S. Stifft, A. D. Cohn, and J. C. Pinnex. Later the Arkansas Diamond Corporation, which now controls the greater part of the diamond-producing area, was organized with Mr. Reyburn as president. Dr. George F. Kunz and Dr. Henry S. Washington were among the early visitors to the district, and both have published several articles on the subject (see bibliography).

In this article are given the results of a recent survey of the corporation's holdings. The paper is published through the courtesy of that organization. Just prior to the survey, several prospecting trenches had been dug, crosscutting the most promising territory and exposing for the first time certain of the formations. These trenches afforded an excellent opportunity to study conditions below the surface.

The company's property is situated about two and one-half miles southeast of Murfreesboro on the north side of the Little Missouri River. The accompanying map shows the location of this occurrence as well as that of other exposures of the rock in the vicinity. On the property outcrops of peridotite occur over an area of about sixty acres. Not all of the formations are the same, however, and in places tuff and sandstone are included in the main peridotite mass. The major physiographic features consist of three hills which extend in a northeast-southwest direction and form the northwest border of the diamond-producing area. The panorama taken from the south side, looking north, will make clear the surface configuration. The tops of the hills are near the level of the surface of the gently sloping plain of Cretaceous sediments as seen from the west of Murfreesboro on the road to Nashville. The prominence of these hills is enhanced by contrast with the broad flat valley of the Little Missouri River. The lower bench-like area crossing the central portion of the panorama records a former level of the river when it was cutting the wide valley it now occupies. To the south



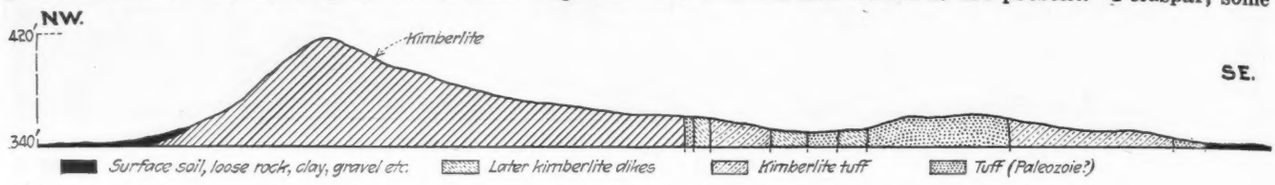
Map of Murfreesboro diamond district, showing location of kimberlite and kimberlite tuff outcrops

is a still lower flat cut by this same stream and coated with deposits of sand and silt from more recent floods.

Peridotite, of the kimberlite variety, and kimberlite tuff are the principal rocks exposed, with tuff and sandstone of an earlier geologic age occurring as included blocks and also at places along the border of the intrusives. The extensive decomposition of the rocks has produced a surface soil composed of black-colored clay, with which are incorporated loose rock fragments and gravel. Much of the property is covered by this superficial material, thus concealing formation boundaries.

However, a prospect trench which cuts the ground in a northwesterly direction toward the middle hill has exposed the formations so that it is possible to determine accurately their structural relation and petrography.

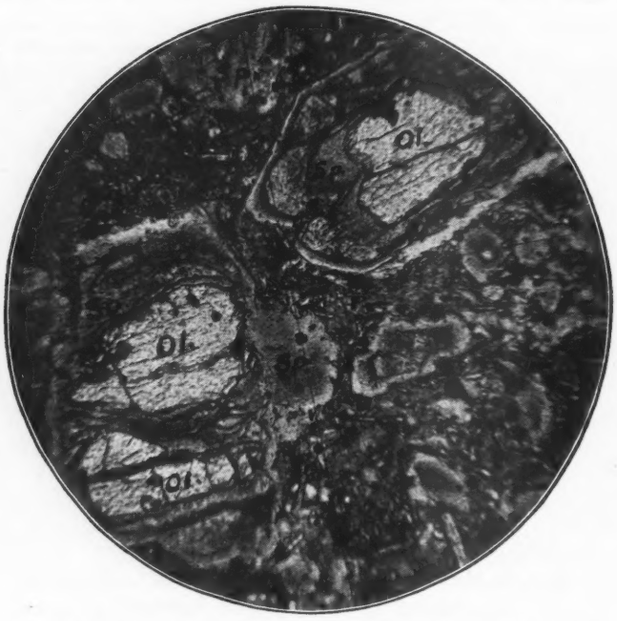
The tuff (Paleozoic?) is present in blocks, around and through which the kimberlite and kimberlite tuff occur. Its pyroclastic habit is not always evident in hand specimens, and in some instances it would be mistaken for impure sandstone. The bluish-gray color, which in places



Structure section of Arkansas Diamond Corporation's property

is very pronounced, together with the fragmental nature of the rock, facilitates its field recognition. Aside from exposures in the section above, outcrops on the third hill at the southwest end of the property offer the best opportunity for field study. The megascopic characteristics are the fragmental character, which, due to the range in size of the rock fragments, is not always determinable without the aid of thin-sections, and its bluish to bluish-gray color.

Yellowish-white earthy grains, which microscopic examination proves to be feldspar decomposed, and mica are recognizable. Quartz and small crystals of pyrite are present. Shale fragments and blocks of sandstone occur as inclusions. In the trench dug in order to determine structure section, the peridotite has penetrated the fragmental rock, forming tiny veinlets associated with the larger dikes. In thin-sections the pyroclastic character is evident, disclosing a wide range in size of rock fragments. Sharp angular outlines bound the bulk of the mineral matter making up the rock, although some slides were examined in which the minerals gave evidence of water action in the form of wear and sorting.



Peridotite, variety kimberlite, showing olivine (Ol) altered to serpentine (Sp.) (Mag. 62 ×)

The following minerals were identified in thin-sections: Quartz, feldspar, biotite, muscovite, chlorite, calcite, talc, topaz, pyrite, ilmenite, leucoxene, magnetite, kaolin, chalcedony, tourmaline, and rutile. In some sections quartz is abundant, the grains being mostly angular, though a few are partly rounded. Inclusions of dust-like material cross the quartz crystals in lines and also occur as disseminated specks. Strain shadows are common and fractures are present. Feldspar, some of which is sanidine, occurs. Biotite and muscovite in basal sections and laths cut across the clevage are plentiful. The micas are in many cases bent and twisted, with quartz filling spaces opened between cleavage plates.

Chlorite, which is responsible for the bluish color, is developed both in the matrix and in the rock fragments. It can be seen as an alteration product of biotite, but in many instances the decomposition is so far advanced that the original mineral cannot be identified. It is likely that some chlorite has formed from pyroxene, as the quantity present can hardly be attributed to mica alone. The outline of chlorite-filled replacements suggests pyroxene as the original mineral. Topaz in basal and rectangular sections is sparingly distributed through the matrix and included in the quartz. Rutile needles are also present in this latter mineral. Pyrite, magnetite, and ilmenite, the latter altered to leucoxene, are scattered through the mass. Kaolin has developed from feldspar, the alteration in most instances being far advanced. A few sections of tourmaline were identified.

Tuff Probably of Paleozoic Age

The geologic history of this formation may be briefly summarized as that of a rock produced by explosive volcanic action, with the resulting fragmental material undergoing partial attrition and sorting by water action. Its structural relation to the associated Paleozoic sandstone, together with its dissimilarity to the Cretaceous, favors placing it in the Paleozoic. Paleozoic ash beds have been found in Polk County, Ark., SE¼ NW¼, Sec. 1, T 5 S, R 32 W[1], which is about 46 miles northwest from Murfreesboro. It might also be noted here that boulders of similar tuff are present in the gravel of streams west of Murfreesboro, especially in the Rolling Fork northwest of De Queen.

Microscopic examination of the peridotite establishes three classes of material: peridotite of the variety of kimberlite, kimberlite tuff, and later peridotite dikes which cut the first two formations. The peridotite proper is best exposed in the middle hill. The rock is dark colored, and numerous pits mark the outlines of decomposed olivines, giving a distinctive appearance to hand specimens. This rock is hard and compact, resisting weathering to a greater degree than the kimberlite tuff. In thin-sections olivine is seen to be the most abundant mineral. The large and small crystals are

[1]Annual Report Ark. Geol. Survey, Vol. 2, 1890, p. 375.

partly or completely altered to serpentine, which feature, together with their porphyritic arrangement in a groundmass filled with small augites, perofskite, and sections of biotite, poikilitically inclosing olivine, small magnetite, strongly impresses the observer. Large rectangular and stubby augite, and magnetite occur. Colorless augite is abundant as small sections in a dense, partly anisotropic, light yellowish groundmass in which are also perofskite, magnetite, and chromite. The augite is in places arranged in fluctional fashion around the olivine and biotite phenocrysts.

Explosive and Intrusive Action Responsible for Kimberlite Tuff

The kimberlite tuff is the result of combined explosive and intrusive action. Incorporated within its mass are small rock fragments picked up on the way to the surface. These fragments are of igneous material, some having practically the same mineral composition, structure, and texture as the peridotite just described, though others are distinguished by the predominance of biotite in a fine-grained, highly decomposed groundmass. The biotite is twisted and bent, but gives little evidence of decomposition. Ilmenite, altered to leucoxene, magnetite, chromite, and a few crystals of topaz are distributed through the matrix. Numerous remnants of olivine altered to serpentine and patches of calcite remain. The decomposition of this rock is pronounced, the most extensive alteration being to serpentine.

The later dikes cutting the kimberlite and kimberlite tuff represent peridotite intrusions choked with fragments of the invaded rocks. Remnants of kimberlite and kimberlite tuff are embayed in a light to dark brown isotropic groundmass. Small sections of garnet, probably pyrope, are present. Altered phenocrysts of olivine which have been stained red by iron are striking features in the thin-sections.

A comparison of the peridotite with a set of seventeen slides from rock in the De Beers mine, Kimberley, South Africa,[2] establishes the following points: Both occurrences are characterized by olivine and mica and would be classed as mica peridotite variety of kimberlite.[3] The texture and structure have much in common. Of the less abundant mineral constituents, the following appear in both: Augite, perofskite, muscovite, chlorite, hematite, chromite, rutile, quartz (secondary), calcite, ilmenite, leucoxene, and magnetite. Serpentine is the predominant alteration product, with chlorite strongly developed in some instances. Included rock fragments are present in specimens from both regions, foreign igneous material being more conspicuous in the rock from Murfreesboro. This latter class of peridotite, in which rock fragments are prevalent, would be designated kimberlite tuff as the name is employed in South Africa.

Over 4,000 stones have been recovered from the property, the size ranging from mere chips to stones of 4, 5, and 6 or more carats. Two larger crystals weighed respectively 18¾ and 20¼ carats. Dr. George F. Kunz has discussed the form, color, and other characteristics of the diamonds.[4] The most common crystals are distorted hexoctahedrons which are sometimes elongated or flattened and possess curved faces. The octahedral faces occasionally show small. shallow. triangular pits. The color varies, shades of brown and yellow being frequent; many of the stones are pure white or blue-white. Crushing is sometimes evident in the form of fractured stones, the fractures often being filled with black mineral matter. Double refraction due to strain can be seen in photomicrographs.

The diamonds already mined have come from the de-

Photomicrograph of tuff (Palaeozoic?) showing pyroclastic habit of rock (Mag. 62 ×)

composed rock and gravel covering the surface of the underlying formations, with the exception of one stone which was found embedded in the decomposed peridotite.[5]

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[2] Thin-sections are from specimens collected by V. Hartog.

[3] "Igneous Rocks and Their Origin," R. A. Daly, p. 446.

[4] "Notes on the Forms of Arkansas Diamonds," G. F. Kunz and H. S. Washington, *Amer. Jour. Sci.*, Vol. 174.

[5] *Amer. Jour. Sci.*, Vol. 174, p. 276, 1907.

THE PETROLEUM INDUSTRY

Texas Oil Output Shows Drop in First Quarter

Decrease Not Likely to Continue—Corsicana-Powell Field Producing Over 80,000 Bbl. Daily and Luling Area Coming Rapidly to Fore

THE total production of oil in Texas during the first quarter of 1923 was 23,561,183 bbl., compared with 26,267,740 bbl. during the last quarter of 1922. The decrease in production during the early part of this year is not likely to continue, however, because of the new fields being developed, and the continued extensions of the old fields.

The history of the new Corsicana-Powell field during the last few weeks has been a succession of completions of one roaring gusher after another, until the total production of the field is now in excess of 80,000 bbl. a day. This is compared with a production of 10,000 bbl. daily during the middle of June. The field has not been developed to its full extent.

The oil and gas division of the State Railroad Commission has refused to allow the use of earthen storage in the Powell field, with the result that steel storage tanks to the capacity of 14,000,000 bbl. are being rushed to completion. The section of Texas between Mexia and Corsicana is fast becoming a great oil-storage center.

In the recently discovered Luling field, Caldwell County, several completions have been made, and there are fifteen producing wells, with a total capacity of 2,000 bbl. Thirty wells are drilling, and many new derricks are being built, so that this field will soon be a factor in the oil production of Texas. The Magnolia Petroleum Co. is erecting ten 55,000-bbl. steel storage tanks here.

The total coastal production has fallen off a little recently, although some good wells have been completed in two of the fields. The most notable of these is the Republic Production Co.'s No. 68 well on the famous Dolbear tract, on the east side of the Hull field, which came in making 15,000 bbl. from 2,480 ft. At Orange the Gulf Production Co. and the Rycade Oil Co. have each completed a 1,000-bbl. well.

At Kingsville, Kleberg County, the Humble Oil & Refining Co. tested its No. 1 well, and it is pumping 25 bbl. This is the first oil-producing well in this gas field. No 2 well will be drilled at once.

Pennsylvania's Oil Output Dropped Slightly in 1922

The oil fields of Pennsylvania in 1922 produced 7,237,437 bbl. of crude oil, or two-tenths of 1 per cent less than the production in 1921, according to figures published by the Secretary of Internal Affairs. Records show that there were 73,492 producing wells last year, compared with 70,639 in 1921, the increase last year being 4 per cent. These wells produced on an average of 98.5 bbl. during the year, a decrease of 4.1 per cent below the average production per well in 1921. Of the total number of wells operated in 1922, 2,666 were brought in during that year. In 1921 there were 2,096 new wells, the increase in new wells in 1922 being 27.2 per cent. Last year 1,919 wells were abandoned, or 45.8 per cent more than the 1,316 abandoned in 1921.

McKean County was the big producer in 1922, with a total of 2,466,723 bbl., compared with 2,311,662 in the preceding year. Venango County was second, with 1,360,093, a drop below 1921, when 1,454,528 bbl. was produced. Butler County stood third with 825,366 bbl., as compared with 874,878 bbl. in 1921. Venango County had 26,271 producing wells in 1922, an increase of 499 wells over 1921. McKean County had 21,258 wells, compared with 19,328 in 1921.

Petroleum Prices Discussed

At the recent meeting of the National Petroleum Marketers Association called by L. V. Nicholas at Chicago, with the purpose of bringing about a change in petroleum prices, several facts were established by the discussion, though there was no definite result, according to the July bulletin of the Mid-Continent Oil & Gas Association. The bulletin summarizes the facts as follows:

"That while there is at least a temporary overproduction of crude oil in California and the Mid-Continent section at this time, the price received by the producers in the Southwest is not in excess of the average cost of production. That, in fact, with runs prorated necessitating tank-building programs and other expense, the oil producer is losing money and probably will continue to do so for several months unless drilling promptly ceases.

"That the Mid-Continent refiner is over-stocked with gasoline as a result of having increased his gasoline output 50 per cent in the first five months of this year over the same period of last year while consumption from his plants only increased 37 per cent, and that while consumption of gasoline now exceeds production, the heavy stocks and keen competition so depress the price that the refiner is certainly and definitely losing money, thus indicating that it is imperative for him to shut down until stocks are reduced.

"That in view of the undisputed facts that the producer and refiner are both losing money, their costs added to the expense of transporting and marketing make it certain that the price of gasoline and other petroleum products to the consumer is not in excess of the cost of finding, producing, refining, and marketing the same. That the consuming public should therefore not demand lower prices at this time, because to put same in effect, with a consequent reduction of the crude oil price, would place in jeopardy 200,000 old small wells in the United States, 40,000 of which are located

in Oklahoma, and their abandonment would deprive the industry and the public of their most dependable source of supply in future months and years; thus is it pointed out that the unique facts peculiar to the oil producing enterprise demand conservation as the higher economic principle outweighing such considerations as the immediate and temporary relation between volume of supply and demand.

It was the consensus of opinion at the meeting that the situation is a serious one, demanding the earnest, active and unselfish co-operation of every one in the industry to restrict production to consumption needs in order to avoid waste and demoralization and secure an orderly marketing of petroleum products at prices fair to the public and necessary to the continued existence of the independent petroleum industry."

Assays of Indiana Shale Reported

Assays of a number of representative samples of oil shale from the New Albany (Ind.) district, made by the U. S. Bureau of Mines, in co-operation with Indiana University, disclose an oil yield varying from 4.8 gal. to 15.7 gal. per ton. The average oil yield for all shale samples tested was 10.3 gal. per ton. The specific gravity of the crude oil varied from 0.924 (A.P.I. 21.6 deg.) to 0.955 (A.P.I. 16.7 deg.), the average being 0.943 (A.P.I. 18.6 deg.).

The amount of tops from the crude oil varied from 38.8 to 52.9 per cent, the average being 44.1 per cent. Apparently the percentage of tops varies inversely with the oil yield—that is, the less the oil yield, the greater the percentage of tops. The exact reason for this is not clearly understood, but it is believed that in retorting a lean shale, at the same rate as a rich shale, there is less mechanical carrying over of the primary decomposition product of the shale kerogen, and consequently the primary decomposition product is more completely broken up, yielding a crude oil with a higher percentage of tops. The tops after standing a few days become intensely red-black color, and if allowed to stand open and evaporate slowly, a small quantity of resinous gum-like material is deposited. This is a characteristic of cracked oils.

The results of this work are given in Serial 2492, by John R. Reeves, of the Department of Geology, Indiana University, which may be obtained from the Bureau of Mines, Washington, D. C.

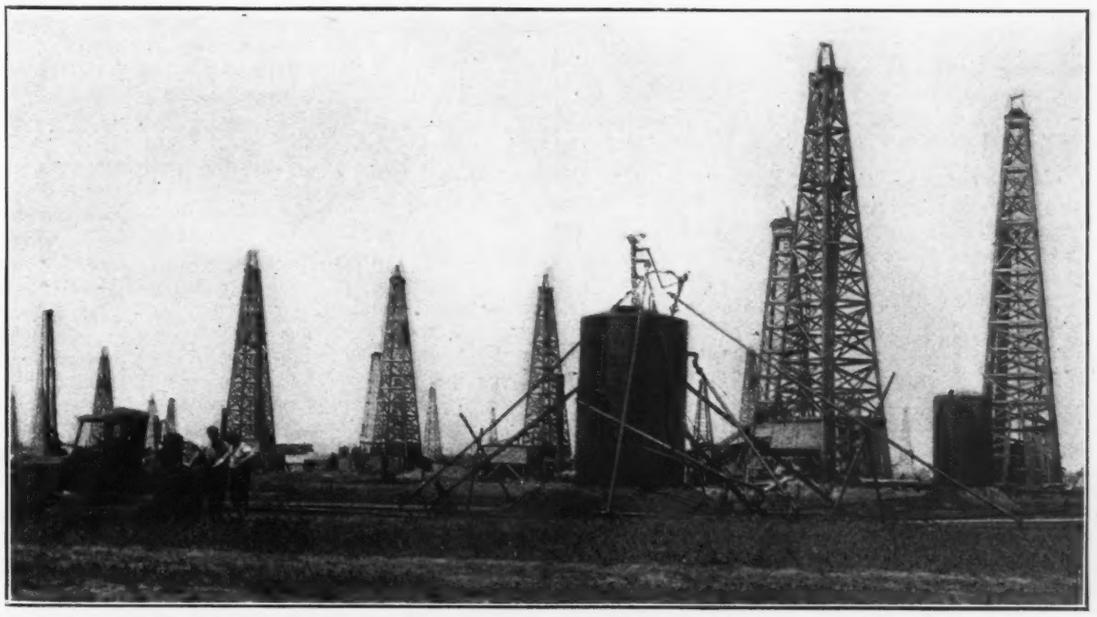
Report on Smackover Field in Preparation

Arrangements have been made between the U. S. Bureau of Mines and the Arkansas State Bureau of Mines to issue a preliminary report on drilling and water conditions in the eastern portion of the Smackover oil field. This preliminary report will cover the heavy oil, the gas dome and the Norphlet areas. A general bulletin on engineering conditions in the Smackover field will be issued later. The contouring and determination of several edge waters and bottom waters have been completed by the Bureau of Mines. Operators in this field are co-operating in this work and are asking for advice on drilling and plugging depths.

Bureau Plans Safety Work in Oil Fields

The San Francisco office of the U. S. Bureau of Mines is arranging to visit the different oil companies to acquaint them with the scope of the technical safety work which the Bureau is taking up. Statistics will be obtained from these companies covering a period as far back as feasible, from which it will be determined which accidents are the ones most frequently occurring. An intensive study will then be made of what appear to be the most prevalent accidents. Technical papers will then be prepared, properly illustrated, and plainly written.

Meanwhile close contact will be established with safety organizations, superintendents, and foremen at various operating plants and when occasion permits suggestions will be offered toward improving practices wherever possible. For the present time the safety work will be confined to the production end of the oil industry. H. C. Miller, an associate petroleum engineer of the Bureau, has been designated to devote his entire time to this work.



A section of the Tonkawa field, Oklahoma's newest oil district of importance. Much of the drilling here is done with rotaries

Recent Technical Publications

Reviews, Abstracts, and References

Treatment of Zinc Ore—The August *Bulletin* of the Canadian Institute of Mining and Metallurgy (603 Drummond Building, Montreal; price, 50c.) is entirely devoted to a 36-page paper on the "Geology and Metallurgical Treatment of the Sullivan Zinc Ore." A brief description of the character of the orebodies and the concentration of the ore by selective flotation is given, followed by a description of the method of treatment of the concentrates. This includes roasting, leaching, filtration, precipitation, purification and clarification of the solution, electrolytic precipitation of the zinc, and melting and casting the bars for shipment. An article descriptive of the selective flotation treatment of this ore will also appear in an early issue of the *Journal-Press*.

Mining and Milling Garnet—*Compressed Air Magazine* for August (11 Broadway, New York City; price, 35c.) contains a five-page article descriptive of the mining and milling of garnet for abrasive purposes at the country's largest plant, that of the North River Garnet Co., North River, N. Y. A special type of "vanning jig" is used, together with concentrating tables and Hooper pneumatic separators, for making a marketable product.

Refractory Materials—In the *Journal* of the American Ceramic Society for July (Columbus, Ohio), appears a 13-page paper by George H. Ashley on "The Fire Brick Materials of Pennsylvania." The paper has also been published separately. Three kinds of material are used for the manufacture of firebrick in Pennsylvania: soft fire clay, hard or flint fire clay, and ganister. The paper describes the occurrences and characters of these clays.

British Mining Laws—As announced in a former issue, the Imperial Mineral Resources Bureau is publishing the mining laws of various sections of the British Empire. Those for the Transvaal and British Columbia have been issued, and those for Victoria, Ontario, and India are under way. The mining laws of Swaziland are just at hand, being published as a book of 168 pages. It is obtainable from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2, England, for 10s. 3½d.

Minnesota Mining Directory — A mining directory for Minnesota for 1923 has just been issued as a book of 170 pages, obtainable from the Minnesota School of Mines Experiment Station, Minneapolis, on request. Maps of the iron ranges of the state are given, with a list of all mines, recent production, location, and names of operators and officials in charge. There is also a list of about 250 of the principal men associated with the iron industry of Minnesota.

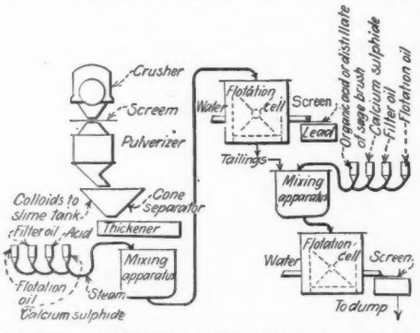
Mine Rescue—Technical Paper 334 of the U. S. Bureau of Mines, Washington, D. C., 44 pages, obtainable on request, is a tentative study of "Mine Rescue Standards." This bulletin is the result of conferences between government, state, provincial, and private groups interested in this work, and is offered as a step toward the desired standardization of equipment and methods.

Arizona Gold Placers—Bulletin 118 of the University of Arizona, Tucson, Ariz., 24 pages, obtainable on request, is an account of the history, production, location, development, and present status of Arizona's placer gold deposits. There are two obstacles to the successful working of these deposits. One is lack of water, and the other the cementation of the gravel by caliche or lime.

American Mining Congress—A report of the proceedings of the twenty-fifth annual convention of the American Mining Congress at Cleveland last October has been issued as a 776-page book, obtainable from the American Mining Congress, Washington, D. C. The discussions cover industrial relations, standardization, mine taxation, and problems of the oil-shale industry.

Patents

Treating Complex Ores—No. 1,452,662. April 24, 1923. R. V. Smith, Eureka, Utah. A method for separating and recovering lead and zinc from lead-zinc ores which consists in sulphidizing the crushed ore in a slightly alkaline pulp, treating it to recover the



lead, resulphidizing the tailing in a pulp made acid by an organic acid, and recovering the zinc by flotation. The process is shown in the accompanying flow sheet.

Reduction of Oxides—Canadian patent No. 230,805. May 8, 1923. A. E. Bourcoud, New York City. A method and apparatus for reducing metallic oxides consisting in mixing a non-combustible gas with atomized fuel at high temperature, thereby converting the mixture to a reducing gas, and bringing the resultant reducing gas into contact, at high pressure, with the oxides to be reduced.

Classifier and Dewaterer—No. 1,453,749. May 1, 1923. N. C. Christensen, Salt Lake City, Utah. An apparatus, comprising an annular trough with scrapers, for dewatering, classifying, and counter-current washing of ore pulp or similar material.

Petroleum—No. 1,456,166. May 22, 1923. C. E. Wilcox, Anaheim, Calif. A working barrel for an oil-well pump comprising a series of liners adapted to fit on a pump plunger, and means for supporting them so as to leave a space around the plunger and between the liners.

No. 1,457,193. May 29, 1923. E. M. Smith and R. E. Heidrich, Los Angeles; Heidrich assignor to Smith. A device for perforating oil-well casings consisting of a cutting head which will fit inside of the pipe that it is desired to slot, and means for operating it.

Treating Galena Ores—No. 1,456,785. May 29, 1923. N. C. Christensen, Salt Lake City, Utah, assignor to the Consolidated Mining & Smelting Co. of Canada, Ltd., Montreal. Ores containing galena are treated with a concentrated salt solution containing ferric chloride, thereby dissolving the lead as a chloride in the salt solution.

No. 1,456,798. May 29, 1923. W. H. Hannay, Trail, B. C., assignor to the Consolidated Mining & Smelting Co. of Canada, Ltd., Montreal. The lead sulphide ore is ground in a neutral liquid and leached with ferric chloride in the presence of sodium chloride. The remaining solids are washed and separated by flotation, and the solution is electrolyzed. This makes a cathode deposit of lead, and an anode regeneration of the ferric chloride solution.

Flotation—No. 1,454,838. May 8, 1923. W. O. Borcherdt, Austinville, Va., assignor to the New Jersey Zinc Co., New York City. A method for improving the flotation of minerals associated with colloidal constituents, comprising dispersing the normally flocculated colloidal matter, removing it from the pulp, and floating the freed mineral.

Thickener—No. 1,454,916. May 15, 1923. A. J. Arbuckle, Johannesburg, Transvaal, South Africa. A design for a tank for separating the liquid and solid portions of mixtures, the thickened material being discharged at the bottom through a central shaft and a pressure-actuated valve.

Zinc Smelting—Canadian patent No. 230,923. May 8, 1923. The Trollhattans Elektrothermiska Aktiebolag, assignee of E. A. Johansson, both of Stockholm, and H. J. Eklund, of Trollhattan, Sweden. A method of preheating zinc ore before smelting, by causing it to slide down a spiral path in a suitable chamber, hot gases passing up in the opposite direction.

Ball Mill—No. 1,455,456. L. L. Sweet and Mike Morley, Wallace, Idaho. A ball mill having perforated liner plates and a peripheral outlet extending around the drum, the design being apparently an intended improvement on the Krupp type of mill.

Societies, Addresses and Reports

Should Metal-mine Air Currents Be Reversible?

D. Harrington and Charles A. Mitke Discuss Subject for Mining Congress — Use of Fire Doors Advocated

ONE of the most interesting features of the discussion at the American Mining Congress Convention at Cleveland last year in the Standardization Conference was that of whether mines should have reversible or non-reversible fans. This argument became quite intense. To get the matter clearly before the public, Charles A. Mitke, chairman of the metal mining branch of the standardization division and also temporary chairman of the mine ventilating section of that division, and Daniel Harrington, of the U. S. Bureau of Mines, were asked to present the viewpoint of their respective organizations. Both Mr. Harrington and Mr. Mitke have prepared articles on the "Reversibility of Air Currents for Metal Mines."

Mr. Harrington says in summarizing his paper:

"1. All main fan installations at metal mines with fans on the surface should have the reversible feature, and where feasible, underground main fans should also have the same arrangement.

"2. In addition to the reversing feature, all fan installations should be fireproof, and all main air-courses should be so equipped with doors that, if necessary, all air flow may be closed to or from the air-course.

"3. To make the reversing feature effective, mine doors should be so constructed as to remain closed, even when the direction of pressure against the door changes. Occasionally in normal times the reversing feature should be tested to make certain of its smooth working in case of emergency.

"4. Booster or distributing fans in use in metal mines to distribute air to 'blind ends' need not be reversible, but should be in a fireproof setting.

"5. While there are instances of loss of life due to reversal of air currents, there are a greater number of instances of saving of both life and of property by use of that feature in both coal and metal mines.

"6. Danger of reversal of air is much greater in coal mines than in metal mines owing to the possibility of explosions, yet coal mine sentiment in favor of installation of reversing feature on main fans is almost unanimous.

"7. It is no more logical to condemn the placing of the reversing feature in connection with main fans at metal mines because of one or two isolated cases of loss of life associated with reversal of air after a disaster than it is to condemn use of hoists for hoisting men because there must have been a few hoisting accidents, or to condemn use of electricity because there have been some deaths in mines from shock.

"8. The cost of installing main fans with the reversing feature is but about 25 per cent greater than without it. The total cost for a fairly large mine would be less than $2,500, and for an ordinary mine not as much as $1,000.

"9. The reversing feature can be used to facilitate ordinary operations. One deep metal mine in the West uses the feature to 'cut' ice out of the operating shaft in winter, and converts the downcast operating shaft to upcast in less than ten minutes.

"10. Any metal mine, which for ordinary operations must for some reason or other maintain a main shaft or travelway as upcast, should certainly have the reversing feature on the fan, since a fire in the mine may at any time fill the shaft with fumes, while quick reversal would give underground men opportunity of exit through the shaft. Such shafts should also have doors at all intersections to be able to isolate the shaft from all air flow if necessary.

"11. Reversal of air currents is hazardous. . .

"12. In general, very few persons care to assume responsibility for changing air flow in a mine at time of disaster; moreover, very few have the special knowledge as to the method of making the change. These conditions alone will, in general, safeguard the reversing feature from misuse.

"13. The direction of main air currents should not be changed except under instructions from the mine foreman, superintendent, or other official who is familiar with the mine and its air currents, and who should also be sufficiently familiar with underground conditions at the time of making the change so that he may realize the probable effect and feel able to shoulder the responsibility.

"14. The placing of the reversing feature on main fans for metal mines is a cheap and effective method of providing insurance against loss of life and property in case of fire. It pays even if never used, and it is likely to yield big 'dividends'—that is to say, prevention of losses—in case it is available and is used in an emergency."

In commenting on Mr. Harrington's paper, Mr. Mitke says:

"In the paper under discussion, it is acknowledged that 'reversal of air currents is hazardous,' and that misuse of the reversing equipment may be attended by disastrous consequences. Also, that technical knowledge and experience is a requisite before authority to 'reverse the air currents' can be vested in anyone, and that such authority usually rests with some high officials.

"Use and experience have demonstrated that no such strictures need accompany the use of fire doors. Anyone, from the shoveler up, may have permission to close them, in case of an emergency, and if they are closed by mistake, no harm results. This eliminates the long delays frequently occasioned through having to obtain permission to reverse air currents from some official who temporarily cannot be located.

"It would, therefore, appear that the installation and use of efficient and well-constructed doors, mechanically controlled, is the promptest, most efficient, and safest method of controlling swift air currents at time of mine fires.

"Since there are no attendant hazards connected with the operation of such doors, and it is being demonstrated daily that they can be closed in far less time than that required to reverse air currents, it would appear that their use should be made of primary importance in connection with the saving of life and property, while the installation of reversing equipment may be considered of secondary importance and left entirely to the option of the management."

Utah Delegates to Milwaukee Convention Appointed

The following delegates, appointed by Mayor Neslen of Salt Lake City, will represent Utah at the annual convention of the American Mining Congress, which will be held at Milwaukee, Sept. 24-29: Frank B. Cook, Ernest Gayford, Imer Pett, J. H. Tonkin, Thomas Valrey, Ernest Bamberger, and W. Mont Ferry.

Business Men Visit Eureka Camp from Salt Lake City

The camp of Eureka, Utah, was the goal of the second of the series of excursions to the mining camps of the state planned by the Salt Lake City Chamber of Commerce. The party left Salt Lake City by train Aug. 12, at 7:30 a.m., and reached Eureka at 11 o'clock, going immediately to the Elks Club, where they were entertained. Walter Fitch, Sr., president of the Chief Consolidated Mining Co., reviewed the history of the camp, and G. W. Crane, geologist, described the geology of the district for the benefit of the visitors. Luncheon was served through the courtesy of the principal mining companies of the camp, after which visits were made to the Chief Consolidated, Tintic Standard, Eagle & Blue Bell, and other mines. The party returned to Salt Lake City in the evening.

Interesting Plans Made for Chemical Exposition

Plans for the coming National Exposition of Chemical Industry at New York, Sept. 17-22, are shaping rapidly. A preliminary announcement concerning the speakers for the students' courses at the exposition has been made, as well as the preliminary program of the motion pictures. The program of the students' course provides for lectures that will be given by men prominent in various phases of the chemical engineering industries.

The motion picture program will be elaborate and interesting and already contains eleven films.

The exposition this year is being held during the week immediately following the annual meeting of the American Chemical Society, as has been the custom in previous years. The A.C.S. will meet during the week of Sept. 10 at St. Paul, and immediately after the close of the meeting its members will entrain for New York for the exposition.

MEN YOU SHOULD KNOW ABOUT

E. P. Crawford has left San Francisco for Mexico.

F. K. Brunton has returned from Mexico and is now in Globe, Arizona.

C. M. Weld, of Weld & Liddell, has returned to New York from a professional engagement in Michigan.

J. F. Thorn, manager for the Simon Silver Lead Mines Co. and the Candelaria Mines Co., has been in San Francisco.

W. A. Carlyle, formerly managing director of the British-America Nickel Corporation, is now residing at Victoria, B. C.

T. J. Donoghue, vice-president and general manager in charge of the Houston headquarters of the Texas Company, is in New York on business.

John D. Ryan, of New York, chairman of the board of directors of the Anaconda Copper Mining Co., is a visitor in the Michigan copper district.

Grant Mahood, president of the American Mining & Milling Co., has returned to Stewart from New York, where he has been in connection with the development of the company's holdings.

A. W. Newberry, mining engineer, sailed from New York Aug. 9 for Africa, accompanied by Norman B. Livermore, of San Francisco. He will be absent from the country ten months.

Le Roy M. Gross and **Frederick W. Foote,** mining engineers, have returned to New York from examinations in the Portland Canal district, British Columbia, and the Wrangel district, Alaska.

W. E. Cockfield, of the Canadian Geological Survey, will investigate the silver-lead deposits of Mayo, Yukon Territory, and the country round the Beaver, where there have been discoveries of a similar character.

Arthur Clark Terrill, professor of mining, Pei-Yang University, Tientsin, China, has gone up the Yangtze into Sze-chuan. He is developing mines in Western China for the Sino-American Syndicate.

Fred M. Miller, mining engineer for the California State Corporation Department during the last eight years, has resigned and is now associated with Smith, Emery & Co., 651 Howard St., San Francisco.

J. Randall, of Nelson, B. C., who has had many years' mining experience in British Columbia, Washington, and Idaho, has been appointed manager of the mill of the Gold Pan mine, in the Rice Lake area of Manitoba.

Frank E. Shepard, formerly president of the Denver Engineering Works Co., has opened offices in Suite 810, Patterson Building, Denver, Colo., as consulting mechanical engineer in mining, metallurgical, and industrial operations.

Charles Francis Williams has recently assumed the position of chief engineer, Charcas Unit, A. S. & R. Co., San Luis Potosi, Mexico. He has an article on the driving of a 1,200-ft. waste-pass at

Charles Francis Williams

that property, on pages 227-229 of the Aug. 11 issue of the *Journal-Press.*

Thomas L. Watson, State Geologist of Virginia, has the following investigations in progress for the state during the present field season: The Mississippian or Pocono coals, in co-operation with the United States Geological

Dr. Thomas L. Watson

Survey; the gold-pyrite belt; the areas of Triassic rocks; the molding, building, and glass sands; the pegmatite bodies for mica, feldspar, and quartz; the Frederick County report; the geology of the Blue Ridge; and several minor problems. Surveys of the Pennsylvanian coals, in co-operation with the United States Geological Survey, iron ores of western Virginia, emery deposits, slate, the Alberene soapstone belt, and aerial mapping of the "Great Gossan Lead," in southwest Virginia, have been completed. Topographic surveys, in co-operation with the United States Geological Survey, are in progress in the southern part of the Piedmont uplands province.

A. J. Bancroft, professor of geology at McGill University, and **E. J. Conway,** field engineer for the Granby company, are in the Salmon River district of British Columbia, and expect to spend several weeks at the Sunshine and George Copper groups of claims.

E. T. McCarthy recently arrived in San Francisco from Korea, where he inspected the French concession. After examining the property of the Mountain Copper Co., in Shasta County, Calif., of which he is a director, he left for Toronto, Canada. He sailed for London from New York on the "Berengaria" on Aug. 14.

W. G. Mather, president, **M. M. Duncan,** vice-president and general manager, and directors **Samuel Mather, Charles Bingham** and **G. Zerbe** of the Cleveland-Cliffs Iron Co. were recent visitors on the Mesabi iron range. **M. H. Barber,** general superintendent on the Mesabi range, accompanied the party on the inspection tour of the company's properties.

O. H. Fairchild, of Fairchild and Fairchild, mining and metallurgical engineers, who recently returned from New Orleans, where he erected a large oil cracking plant using the Dubbs system, sailed for Tokio, Japan, Aug. 9 on the "President Wilson." While in Tokio he will erect several units of the Dubbs process for the Nippon Oil Co. of that city. En route to the coast he made mineral and timber investigations in Colorado for Norman D. Fraser, of the Fraser estate.

OBITUARY

Raphael Pumpelly died at Newport, R. I., on Aug. 10, in his eighty-eighth year. Mr. Pumpelly was widely known as geologist and mining engineer. He was professor of mining at Harvard from 1866 to 1873, State Geologist of Michigan from 1869 to 1871, director of the Missouri Geological Survey from 1871 to 1873, and later chief of division of the U. S. Geological Survey. He had also made extensive investigations for the United States and for foreign governments in many lands. Mr. Pumpelly was the author of numerous geological and mineralogical reports and surveys and published in 1920 a volume of reminiscences and adventure. He is survived by two daughters and a son.

I. F. Hodges, mine superintendent, Corporation Minera de Famatina, Santa Florentina, Chilecito, Argentina, was instantly killed on June 23, while showing his men how to charge a drill hole. He had warned them to stand aside, so that no one else was injured. It is thought that the accident was caused by frozen dynamite.

Harry Scott, a well-known resident of Cochise County, Ariz., died recently in Douglas, after a long illness. He had served at times as correspondent for the *Journal-Press* in various camps.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

IMPORTANT DEVELOPMENTS are presaged in California's electrometallurgical industries, as a result of recent research and investigation.

Calumet & Arizona Mining Co. will likely acquire El Tiro property.

Arizona metal producers succeed in obtaining lower freight rates.

Territory east and north of the Portland Canal district in British Columbia may be opened by better roads.

Gold and Silver Commission sends representative in the field to obtain sentiments of producers.

The Orphan Girl mine, in Butte, resumes operations.

The arrival of Cornish miners in northern Michigan helps to relieve labor shortage.

The Russo-Asiatic Corporation is looking for holdings in northern Manitoba.

Ray Hercules, in Arizona, closes down.

Mayo lead shipments from the Yukon are expected in Kellogg, Idaho, soon.

Hecla Mining will continue dividends, reports say.

Northern Michigan mines storing coal in preparation for any contingency.

Mayo Lead Shipment Expected at Bunker Hill Smelter

High-Grade Ore from the Yukon Is Initial Production—First Shipment Will Be About 1,100 Tons

The first of four carloads of silver-lead ore to be shipped from the Mayo district of the Yukon territory to the Bunker Hill smelter, in the Coeur d'Alenes, is expected to arrive at the smelter in a few days, according to an announcement made recently by Frank M. Smith, smelter director of the Bunker Hill & Sullivan Mining & Concentrating Co. The first shipment will consist of approximately 1,100 tons of high-grade silver-lead ore, which is sufficient to fill 29 freight cars to capacity. Each car will contain 767 sacks of more than 100 lb. weight each.

The ore was mined and shipped by the Treadwell-Yukon Co., which is owned jointly by the Bunker Hill company and the Alaska-Treadwell company. F. W. Bradley, of San Francisco, is president of both companies. The mines are located in the Mayo district, on the western slope of the Rocky Mountains, in the southeastern part of the Yukon territory.

"Mr. Bradley has been interested in the Mayo district for two or three years," said Mr. Smith. "He has opened up some wonderful deposits of high-grade silver-lead ore."

A total of 4,000 tons of ore is to be brought out this season, it is reported. The ore is being moved in bond from the mines to the Bunker Hill smelter, which is a bonded warehouse. As soon as the ore reaches the smelter it will be sampled and assayed and the duty of 1½c. per lb. on the lead content will be paid to the government.

Explosion of Compressor at Never Sweat Mine

The compressor plant at the Never Sweat mine, one of the oldest copper mines in the Butte district and one of the Anaconda properties, is almost a complete wreck due to an explosion in the system on Aug. 5.

The receivers, pipe lines and parts of the compressors were badly damaged. All of the windows were broken and a large section of the roof of the compressor room was torn off.

Fortunately and miraculously, no one was seriously injured, although three men were working in the plant at the time of the explosion. One of the men was slightly injured by flying glass.

The cause of the explosion is not definitely known, but it is thought that it was due to the oil in the air becoming overheated. The plant will be repaired as soon as possible.

Northern Ontario Dividends May Break Records

Dividends paid by gold and silver mines of northern Ontario so far this year amount to over $6,000,000, and it is probable that disbursements to shareholders will be greater than for any time during the last ten years. Dividends ordinarily expected will bring the total to $8,500,000. This year to date $1,355,000 has been paid by silver mines of Cobalt and South Lorrain, $4,447,877 has been paid by Porcupine gold mines, and $257,500 by Kirkland gold mines. The new dividend payer on the lists is the Keeley mine, of South Lorrain, which paid one dividend six months ago and has just declared another dividend of 8 per cent.

Michigan Copper District Strong for C. & H. Consolidation

Lake Region Would Gain by Economies Effected—Construction and Development Await Decision

It appears to be the consensus of opinion in the Michigan copper district that the proposed consolidation of Calumet & Hecla, Ahmeek, Allouez, Centennial, and Osceola should be consummated not only for the advantages which would accrue to the new company but for the future development of the Lake region. Ownership of an immense acreage of copper-bearing land, convenience in exploration and development, reduction of costs, elasticity of labor, and better assurance of a more profitable market are the weighty factors advanced in favor of the merger plan. The Michigan district, it can be said without fear of contradiction, is for the consolidation.

Proposed construction of a railroad connecting Ahmeek, Allouez, and North Kearsarge with the stamp mills by a direct route would result in a sharp reduction of transportation costs. The route, which has already been surveyed, avoids bad grades and considerably shortens the distance. The rock trains, on the return trip from the mills, would transport fuel and supplies for the mines. Other reductions in costs to the consolidated company would come in bulk buying of materials and supplies, centralization of operations and power and utilization of available labor to the best advantage.

It is believed operations would be resumed without much loss of time at the North Kearsarge branch of Osceola in the event of approval of the merger plan. The property is in splendid con-

dition and ready for reopening. Completion of the haulage tunnel at the 81st level of the conglomerate department of Calumet & Hecla and enlarged production from this branch also are expected if the consolidation is voted. The haulage level, from which the lode will be mined at great depth, has been "holed" through, but is yet to be equipped.

To Open Territory Northeast of Portland Canal

George Clothier, who has been on a brief visit to Victoria to consult with William Sloan, Minister of Mines, in regard to road and trail construction in the northwestern section of British Columbia, which he represents as government mining engineer, is much interested in the opening up of the territory east and north of Portland Canal drained by the Unuk, Stikine, and Iskut rivers. He has completed a trip through parts of this region and is more than ever confident that it is a field of promise from the viewpoint of prospectors. Difficulty of access is its present handicap. It can be reached by topping the Salmon River glacier or by traveling up the Unuk River from Burroughs Inlet, Alaska. The practical method would be the construction of a road through Alaskan territory to the Canadian boundary and the continuation of this road some distance into the little explored district. With such a main artery it would be possible, as the need arose, to open the country with branch trails. To carry out this comprehensive proposal the co-operation of the Alaska Road Commission is required, and it is understood that representations are to be made to that body. The British Columbia Department of Mines, it is said, would be prepared to do its part if assured of the assistance indicated from the American authorities.

Peirce-Smith Patents Upheld

Judge Morris Decides That United Verde Infringed

In an opinion filed on Aug. 11, Justice H. M. Morris of the United States District Court for Delaware decided that the Peirce-Smith converter patent was valid and that the United Verde Copper Mining Co. had infringed it. The Peirce-Smith process uses a basic lined converter and a careful regulation of acid flux and the blow. An extract from Judge Morris' conclusions follows:

"Does the defendant infringe? In view of the interpretation herein placed upon the patent in suit this matter needs little consideration. Broadly speaking the defendant contends that it operates under the Wheeler and Krecji patent No. 1,068,470, and not under the patent in suit, but, as I understand the Wheeler and Krecji patent, it does not disclose a process different in principle from that of Smith but is merely an improvement in the technique or method of conducting the Smith process. It is not disputed that the defendant carries on the process of bessemerizing copper matte in a converter having a magnesite lining with the employment of an acid flux; that it forms a molten bath of matte in the converter of such volume as to retain its fluidity as against losses by radiation during the blow; that it proportions the amount and composition of the flux to the volume of air blast admitted; that it obtains a thin and fluent slag; and that by those steps the life of the lining of the converter is greatly prolonged. Such process is clearly within the Smith claims as hereinbefore interpreted. The defendant says, however, that before it begins the bessemerizing operation it blows a charge of matte without flux and by so doing produces sufficient magnetite to cover the magnesite lining several inches in thickness and that consequently its bessemerizing operation is carried on with a magnetite lining and that such lining is not 'non-corrodible' as called for by Smith's claims. The specification, however, expressly states, page 4, lines 61 to 64, 'that by the expression non-corrodible lining as employed in the specification and claims, I mean a lining of a non-acid character.' Magnetite is of a non-acid character and so 'non-corrodible' as that term is used in the claims."

Michigan Copper Producers Taking No Chances

COAL receipts in the Michigan copper district have been heavy this season of navigation and there will be no dearth of fuel for the next year. The mines have taken no chances on a possible coal strike and have stocked up with more than adequate supplies. Calumet & Hecla coal receipts to date are approximately 300,000 tons and other docks also are well stocked.

Calumet & Arizona Likely to Acquire El Tiro Mine

John C. Greenway, general manager of the Calumet & Arizona Mining Co., in reply to press notices to the effect that his company had secured a lease on the El Tiro property, in Pima County, Ariz., has stated that while the negotiations have not yet been completed, it is likely that an arrangement will be consummated. The negotiations are awaiting the signature of Gordon R. Campbell, president of the company, who is in the East. The El Tiro property, which consists of the Silver Bell mine, is about 50 miles from Tucson, at Silver Bell, Ariz., and is owned by the El Tiro Copper Co., of Philadelphia The mine has been operated by the El Tiro Leasing Co. since April, 1919, but it has been announced that the company will suspend operations on Aug. 15, due to the low price of copper and lack of funds with which to carry on development.

Curtailment at the El Tiro property was started about July 1 last, up to which time there had been about 125 men employed in the operations at the mine.

Kirkland Lake Will Have Better Power Supply

In order to provide for the growth of the Kirkland camp and the increased demand for power which will take place as soon as the present plans of some of the mines are completed, the Northern Ontario Light & Power Co. is doubling the power supply to Kirkland Lake. Another transmission line, paralleling the first, is being built, and other necessary equipment will be added. The present peak load is 3,800 hp., and although the present line has a capacity of 5,000 hp., this will soon be taxed. With the increased milling capacity of the Lake Shore and the probable starting of the Tough Oakes mill, the demand for power will be much greater.

Teck-Hughes Provides for Pumping Emergency

The output of the Teck-Hughes for July was $80,500. This is a decrease from the two previous months and is partly the result of a break in some of the mill machinery. To overcome difficulties experienced in the mill by interruptions in the power service, the company has installed a gasoline engine of 125 hp. capacity, which is sufficient to keep the pumps running and keep the pulp moving in the mill when power is off. New rolls for the Wright-Hargreaves mill, which will bring the crushing plant up to 700 tons a day, have arrived and will be installed soon. The increasing of the rest of the mill capacity has, however, been put off until next year. Part of the plant for the Continental Mines has arrived on the ground and is being installed. As soon as the plant is completed, sinking will be started and will be continued to 700 ft.

Tintic Milling Re-treating Dumps

The Tintic Milling Co., at Silver City, Utah, which has for a number of years, been treating the low-grade siliceous silver ores of the Tintic district, especially those from some of the Knight properties, such as the Iron Blossom and Colorado, and saving the silver contents, is re-treating some of the material on its dumps and receiving the sulphide ores necessary in the roasting process, from the Iron Blossom and Tintic Standard mines. It is expected that this work will continue through the summer and that the mill will thereafter close down for a period. The fall in the price of silver is a factor in closing the property.

Tintic Milling successfully solved the problem of treating the low-grade siliceous silver ore of the district. For some time lately the company has not been getting enough ore to operate at its greatest efficiency. There is a large tonnage of low-grade ore still in the district, but this is not amenable to the process of milling. The company will continue to take low-grade siliceous ores from the Knight mines, as long as operation continues.

Alberta's New Mineral Tax in Effect

Assesses 3c. per Acre on Mineral Lands —Large Companies Heavily Affected

The new mineral lands tax imposed by the provincial government of Alberta came into effect on Aug. 1. A tax of 3c. per acre is levied on all land held under oil, gas or other mineral leases of any kind, or under a mineral title. Much of the land affected by this tax is held under titles issued prior to 1887, when the title gave rights to the minerals as well as the land. The owner of such land, where no proof exists as to the occurrence of minerals, has the right to elect whether he will pay the tax or forfeit the right to the minerals.

In the case of mineral land held under lease from the Dominion government the act provides that where the tax is not paid action will be entered in the courts for its recovery. The tax, which is expected to yield $300,000 in the year, will bear heavily on some of the large corporations like the Canadian Pacific Ry., the Hudson Bay Co., and the gas companies.

Russo-Asiatic After Northern Manitoba Holdings

Interested in Recent Copper Discoveries —May Spend Large Sum on Development

Representatives of Russo-Asiatic Consolidated, Ltd., a large British mining company, have been in Winnipeg for some days negotiating with holders of groups of claims in the recently discovered copper belt in the Bear Lake and Bird River districts of Manitoba to secure their interests. Fred W. Draper, consulting engineer of New York, special representative of the company in America, states that the purchase of the property by Russo-Asiatic Consolidated would result in the expenditure of several million dollars for development and the erection of smelters in the district. Mr. Draper and H. H. Knox, consulting mining engineer of New York, left Winnipeg on Aug. 3 to investigate thoroughly the possibilities of the new mining district. The company at present operates large copper and zinc mines in the Russian Ural Mountains and eastern Siberia in which it has invested $50,000,000.

State Fair at Sacramento Will Feature the Mining Industry

An extensive mineral and mining machinery exhibit will form a feature of the forthcoming State Fair at Sacramento, Calif. The minerals will be housed in three sections in the main exhibit building, Agricultural Hall.

It is planned to devote 8,000 sq.ft. to mining machinery and equipment. Several crushing units will illustrate methods of breaking ore; and there will be a complete working model of a five-stamp mill. It is planned to have a gold dredger in operation, as well as rock drills and air compressors. One working exhibit will illustrate the operation of the cyanide process.

The Bureau of Mines is arranging for a mine-safety and mine-rescue exhibit. Bert F. Hews, the manager of the Department of Mines, Sacramento Chamber of Commerce, states that it is planned to maintain a permanent mineral exhibit at Sacramento; the majority of the minerals will be removed to the Chamber building at the close of the fair.

Minnie Jane Makes Initial Ore Shipments

The Minnie Jane property, in the West Butte mining district, not far from the well-known silver producers, the Nettie and the Hibernia mines, recently shipped three tons of high-grade gold ore that netted approximately $900 per ton. Officials of the company state that the vein from which this ore was mined continues to show high values and that drifting is being done from the bottom of a winze that is 80 ft. below surface. The average width of the vein is about 16 inches.

Arizona Mining Companies Obtain Lower Freight Rates

Also Seek to Have Tax Assessments Levied on a More Equitable Basis—Commission Makes Decision Retroactive on Powder Shipments

AT PRESENT, when operating costs are almost equal to those of the war period, labor is scarce and unsatisfactory, and the market conditions for copper are such that economical production is absolutely necessary, Arizona operators have waged a program for freight and tax reductions during the present year that bids fair to result in much relief to the industry.

One of the most recent decisions that will mean a great saving to the mining companies of the state is that effecting the shipment of powder from the plant of the Apache Powder Co., to the mines, the state corporation commission having ordered a reduction of freight rates on all lines equivalent to 40 per cent of the rate previously charged. The commission also directs that the railroads return to the companies all amounts collected during the last two years in excess of the new schedule of rates. In making the reduction retroactive for that period it is estimated that a total of over $30,000 will be returned to the companies. The Apache Powder Company is owned by many mining companies operating in the state, the factory having been erected at Curtis, Ariz., about two years ago, which is a centrally located shipping point. The hearing of this rate case was conducted before the commission last March, having been instigated by the powder company in conjunction with the mining companies and traffic associations.

The decision favoring the mining industry in powder shipments was preceded by a decision that granted the Globe-Miami mines main-line freight rates, which was also an important victory and one that will mean a great saving to the producers of that place. The United Verde Copper Co. and the United Verde Extension Co. are now waging a fight on freight rates for the shipment of bullion to the West coast, and it is expected that a concurrence will be obtained in the contention that these rates are unfair. The Binghampton Copper Co. was awarded a victorious decision in a hearing before the commission last May. This company sought a reduction of rates charged for the shipment of concentrates from the property at Stoddard, in the northern part of Arizona, to the smelter, at Hayden. The decision ordered a reduction to become effected July 1.

In addition to the efforts to secure just freight rates, many operators are appealing for more adequate assessments and it is likely that tax adjustments will be obtained. The most important of these is that of the United Verde and United Verde Extension companies, which are seeking what is claimed to be a fair assessment based on the actual cash value of the holdings. This appeal attacks the methods of the state tax commission, whereby the assessment is based on the earnings of the companies over a given period, and, if successful, would mean a readjustment of taxes of nearly all mines in the state. The Calumet & Arizona company recently appealed for a readjustment of the assessment on the sulphuric acid plant which is situated at Douglas. The company advanced the argument that the plant would become obsolete within a few years when the acid is no longer needed for the treatment of New Cornelia's oxide ores. The Phelps Dodge Corporation is to be given a hearing before the state board of equilization concerning assessment of the corporations holdings. Shannon Copper company is to appear and other companies will also be heard.

Though many of the appearances before the board are for a friendly discussion of the assessment imposed this year by the tax commission, it is expected that a more satisfactory adjustment in some cases will be effected. In securing a reduction of freight rates and the possibilities of tax adjustments, Arizona operators are taking a big step toward relieving present stringent conditions due to high production costs.

Parts for C. & H. Reclamation Dredge Delivered

STEEL for a dredge, the principal unit of the new reclamation plant which Calumet & Hecla is building on the Tamarack conglomerate tailing deposit, is beginning to arrive. The machinery is already on the ground. The hull will be assembled at the Pointe Mills drydock, and it is hoped to complete this work in time to tow the craft to its permanent location this fall. Work of installing the tanks and other equipment for the leaching process in the new plant is progressing favorably and completion of the entire project is looked for in the spring of 1924.

Indian Mines Corporation to Increase Capitalization

Hope to Raise Funds for Development Work

At a general meeting, held at Prince Rupert recently, the shareholders of Indian Mines, Ltd., decided to change the name of the company to Indian Mines Corporation, Ltd., and to increase the capital to $3,000,000. The capital previously was $1,600,000, of which $1,500,000 has been issued. It is the purpose of the directors to issue immediately $750,000 of the new stock, with which to continue development operations and exercise options that the company holds on adjoining properties, leaving $750,000 worth of stock in the treasury, which will be issued as money is needed for the equipment of concentrating mill and other plant.

The company owns four claims, situated to the northwest of but not contiguous to the Premier Gold Mining Co.'s property. Two adits have been driven on a vein that has been traced by open cuts for more than 1,000 ft. on the surface. No. 1 adit gives an average depth of 50 ft. It has been driven for about 300 ft. on a vein ranging from 10 to 18 ft. in width, and averaging $14 in gold, silver, and lead per ton for the full distance. No shipping ore was found in this adit.

No. 2 adit, 150 ft. below, has been driven for about 500 ft., most of the distance in milling ore. At one point the vein appears to have been thrown out of its course by faults, but was picked up again on its true course after the tunnel had been driven for a distance through barren ground. The adit passed through a shoot of high-grade ore, giving about 8 ft. of steel galena. Similar ore was found in one of the open cuts on the surface, but was not found in the upper adit. The principal value of the milling ore is in gold; where the galena is found the ore is rich in silver. A lower adit, to give an additional 150 ft. depth, has been started. The property is about a mile from the main road, on the west side of the Salmon River, and about 15 miles from Stewart. Arrangements are said to have been made for the underwriting of the whole of the new issue in London; most of the present issue is held in Montreal and Toronto.

Quebec Asbestos Mills Operating Normally

New Plants Are Being Erected

The majority of the mills in the Quebec asbestos district are running at capacity. Reports from most of the producers show that they are promptly disposing of all grades up to an including shingle stock. The prices of long fibres and crudes have been reduced with a view to meet foreign competition. The stocks of long fibres are gradually being decreased. The labor situation is unchanged, with a fairly plentiful supply, and the present scale of wages, so far as can be ascertained, satisfactory.

In Thetford Mines, the Asbestos Corporation of Canada is rapidly completing its new mill to replace the King mill, which was recently burned. Selective Treatments, Ltd., has built and equipped a plant on the Bennett Martin property and is running a series of tests on wet concentration of asbestos. Consolidated Asbestos, Ltd., is marketing a new grade of fibre known as "non-dust," made by a special process.

In Black Lake the Black Lake Asbestos & Chrome Co. is again operating at capacity. The Mapleleaf Asbestos Corporation has made arrangements for additional equipment in its mill. It expects to start steam-shovel operations at an early date. The Asbestos Fibre Corporation has completed a new residence for its manager and is planning to complete its plant soon.

Johns-Manville, Inc., has had plans drawn for a large manufacturing plant to be built close to its mines at Danville. The Quebec Asbestos Corporation is running full. The plant of the Asbestos, Ltd., is now completed and in operation.

Developments Presaged in Californian Electrometallurgical Industries

Ishi Pishi Dam to Provide Power for Electro-Metals Co.—State Fish and Game Commission Opposes Project

IMPORTANT DEVELOPMENTS in electrometallurgy in California are presaged by the announcement which we made last week that plans have been proposed and the necessary state permits granted for the construction of a dam at Ishi Pishi Falls, on Klamath River in Siskiyou County, which will create a lake 19 miles long, at the base of which a 110,000-hp. hydro-electric plant will be erected. This project, sponsored by the Electro-Metals Co., is preliminary to the manufacture and distribution of electrometallurgical and chemical products at a point on the California seaboard.

The Klamath River, with a minimum flow of 2,000 sec.-ft., drops 4,000 ft. as it comes from Klamath Lake, Ore., to Requa, Del Norte County, Calif. The Ishi Pishi Falls are just above the confluence of the Klamath and Salmon rivers. At State Creek, 17 miles below, it will be possible to generate an additional 40,000 hp. The distance from the main power station to a potential deep-water harbor at Trinidad, Calif., is 42 miles. The proximity of ample power to cheap transportation, by which raw material can be delivered to the works, indicates almost unique geographical advantages for the venture.

The Electro-Metals Co. is exceptionally well equipped to carry the project to a successful technical and business conclusion. Officials include Bulkeley Wells, vice-president and managing director of the Metals Exploration Co.; W. W. Crocker, vice-president of the Crocker National Bank San Francisco, and William Braden, former president of the Braden Copper Co., of New York. Frank Langford, mining and electrochemical engineer, has made a study of plants and processes in operation in France, Germany, Switzerland, and Scotland, and has visited the bauxite deposits of France and Italy, as well as other potential deposits in Ceylon and India. The result is that sufficient data are available to indicate that ore could be delivered at Trinidad or Eureka, Calif., at a lower cost than would be incurred by a railroad haul of a few hundred miles. Construction work on the new dam is expected to begin forthwith by the contractors.

The State Fish and Game Commission has opposed the company in its program of development on the Klamath River. This opposition, it is contended, is based upon the belief that dams necessary to the development of power on the Klamath would destroy the run of salmon and steelhead on that river and its tributaries.

Officials of the Electro-Metals Co., however, assert that salmon, the only fish taken commercially, is of insignificant economic importance in California. Moreover, they contend that the belief of the Fish and Game Commission that development of power projects will destroy the run of salmon is not confirmed by the Federal Bureau of Fisheries. The company also challenged the Fish and Game Commission in its contention that sport fishing on the Klamath would be destroyed by the contemplated power project. It is maintained that objections emanate from those who have adopted the attitude that their pleasure takes precedence over the development of natural resources of industrial benefit to the state.

News from Washington

By PAUL WOOTON
Special Correspondent

Gold and Silver Commission Doing Field Work

Appoints Fletcher Hamilton to Obtain Views of Mine Operators and Prospectors

In order to obtain at first hand the views of producers regarding the causes and possible remedies of the slump in precious metals in the last few years, the Senate Commission on Gold and Silver Inquiry has appointed Fletcher Hamilton, a mining engineer of San Francisco, as field representative. By sending a representative among the mine operators and prospectors of the western fields, the commission hopes to be able to get at some of the fundamentals of the problem as they appear to men of practical experience. The commission has asked that the mining men approached by Mr. Hamilton give the latter their views freely and fully. The appointment of a western field representative is expected to inspire increased confidence among producers and prospectors that the commission is determined to get as close to basic facts as possible.

It is expected that valuable first-hand information will be obtained by Mr. Hamilton at the hearings he will conduct in the western gold- and silver-producing states to develop facts regarding the conditions in the industry and that the personal contact thus established between the commission and the mining men will prove of assistance to both in approaching the problems.

Mr. Hamilton for more than ten years was a mineralogist of the California State Mining Bureau. He was graduated from the University of California in 1904 and he has had practical experience in mine operation and engineering in Arizona, Nevada, and Montana, as well as in California.

The field investigations will seek to discover the causes of the continued decrease in gold and silver production and will cover also much of the ground of the commission's general inquiry into production, reduction, refining, transportation, marketing, sale and uses of gold and silver and the effects of diminished production upon commerce, industry, exports, and prices.

Letters from a number of important mining men have been received by the commission, accepting the invitation to attend the conference which will be held at Reno, Sept. 4, and the success of this gathering from the attendance standpoint appears to be assured.

The Department of Commerce, which is co-operating with the commission in some of the phases of its work, will be able to present a report at the Reno meeting on the results of the questionnaire regarding the foreign monetary situation which was sent the trade commissioners and other foreign representatives of the department, and also results of a study of the gold and silver situation in India and China.

Production of gold from refineries in the calendar year 1922 was valued at $48,849,100, which is a decrease of $1,218,200 below the figures for 1921, while silver production in the year was $56,240,048—at $1 an ounce—which is an increase of $3,167,607 above the 1921 production, according to statistics announced Aug. 11 by F. E. Scobey, Director of the Mint. In 1915, gold production was valued at $101,035,700 and silver production was 74,961,075 oz.

Tariff Commission To Investigate Magnesite

Will Include Raw and Finished Materials

An investigation into the costs of magnesite production has been ordered by the Tariff Commission under the terms of the flexible tariff on the application of four Austrian companies which export the product to the United States.

The investigation will include magnesite brick in paragraph 201 of the 1922 tariff act, and crude magnesite, caustic-calcined magnesite, and dead-burned and grain magnesite not suitable for manufacture into oxychloride cements which appear in paragraph 204 of the act. Thus in its investigation the commission will include the product used in stucco and other construction material and the magnesite used in steel manufacture.

The applicants for this investigation are the Vertschee Magnesitwerke, A. G.; Austro-American Magnesite Co.; Ateirische Magnesit-Industrie A. G.; and the Magnesitwerke, Eichbergane.

The duty on magnesite brick is three-fourths of 1c. per lb. and 10 per cent ad valorem as compared with 15 per cent ad valorem in the tariff act of 1913. Crude magnesite in the present act bears a duty of five-sixteenths of 1c. per lb.; caustic calcined magnesite, five-eighths of 1 c. per lb., and dead burned and grain magnesite not suitable for manufacture in oxychloride cements, twenty-three-fortieths of 1c. per lb., while in the tariff act of 1913 these magnesite products were free of duty.

News from Mining Districts

By Special Correspondents in the Field

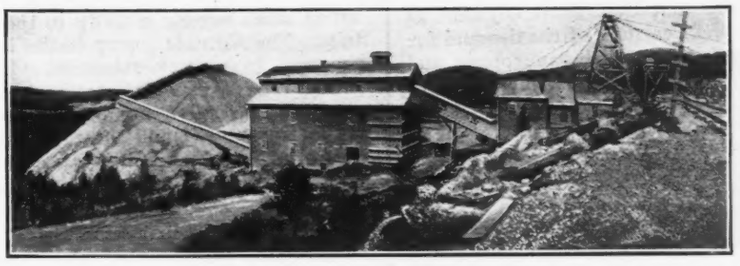
London Letter

Block 10 Mine For Sale—Selukwe Mine Shares Slump—Great Boulder Perseverance Being Revived

BY W. A. DOMAN

London, Aug. 2, 1923—Labor conditions at Broken Hill have settled the fate of the Block 10 Mine. It is a low-grade property, with about 150,000 tons of ore in reserve. To extract this at a profit, working expenses have necessarily to be kept low. The Edmunds award, which fixes rates of wages at Broken Hill, does not permit of profitable operations, seeing that the miners would not work more than five days a week, with six actual working hours a day. When lead was £29 a ton, an attempt was made to resume operations, but funds gave out and £20,000 was borrowed from Amalgamated Zinc (De Bavays). It is proved that this mortgage cannot be redeemed by working, and consequently the mine is for sale. At one time it was the second producer of the field. Dividends, however, have apparently gone forever.

The position of the Selukwe Mining Co., which owns a controlling interest in the B. C. Silver Mines, does not seem to be quite clear. Views certainly are conflicting. Not long ago the company made an issue of shares of the par value of 2s. each at 20s. and during the week they have been quoted at 8s. "nominal." As in all such cases, rumors are current



A typical Quebec asbestos mill

Plant of the Maple Leaf Asbestos Corporation at Black Lake Dump at left; mill building in center, derrick leading to mine pit at right

which it is not easy to check. For instance, it is said that Edmund Davis is interested in some way, and that he has written to a friend to get out. Others say that the B. C. Silver Mine is a good one, but that named parties are playing into the hands of the Guggenheims. Another report is to the effect that G. A. Denny has stated that the mine has virtually no ore reserves. These rumors, which are so unsettling, account for the fall in the price.

Owing to the fact that native labor in the Gold Coast Colony can find remunerative work in growing tropical products, the Abbontiakoon Mines has been short of "boys." The supply is fairly intelligent, but, strangely enough, rock drills are not thoroughly understood. A new type is now being sent out, and it is hoped that better progress will be made. Despite the drawback mentioned, working costs last year were reduced from 47s. 4d. per ton to 40s. 10d.—a creditable performance. Ore reserves are slightly in excess of 476,000 tons, and stand in the balance sheet at 5s. 7d. per ton. The value of this ore is 10 dwt., and to improve the financial position, development work is being curtailed and a greater quantity is being crushed.

At the meeting of the Great Boulder Perseverance Mine (Western Australia) held yesterday, the scheme for resuscitating the company—to which I referred last week—was adopted unanimously. Apparently there was no criticism of it and everyone seemed more or less enthusiastic. Nothing was said as to why the liquidation should be terminated and a new company formed. There is apparently something like £140,000 in profit to be extracted. Under the liquidator, C. F. Bell, working expenses have recently been kept very low.

"Cousin Jacks" Arriving in Northern Michigan

A CONSIDERABLE number of Cornish miners are coming into the Michigan copper district direct from Cornwall. A party of twenty-nine experienced men recently arrived at the Copper Range mines, coming principally from the Camborne and Redroth districts of Cornwall. They explained that there has been a bad slump in the Cornish tin industry, many mines having been forced to suspend operations and that unemployment is acute. Learning of the demand for labor in the Michigan copper and iron fields, a large number have decided to come to this country, and the new arrivals predicted they would be followed by many more, as fast as the immigration restrictions will permit.

The Cornish miner is skilled, steady and reliable, and the men now coming in are a welcome addition to underground forces.

BRITISH COLUMBIA

Britannia Beach Mill Working at Capacity

The Britannia Mining & Smelting Co., Howe Sound, is reported to have mined 75,000 tons of ore during the month of July. Its plant at Britannia Beach, substantially increased in size and brought up to date in every particular, is working at capacity. About 500 men are employed underground. The management continues its policy of prospecting and developing new ground while extracting ore already blocked out. Entirely new ground is being prospected in the Indian River district back of the present workings.

Tonkin Interest in Fish Creek Mines Acquired

It is announced that Samuel I. Silverman, of New York, has acquired the interest of W. R. Tonkin in the Fish Creek Mining Co., control of which is held by the American Mining & Milling Co. The latter company has purchased the Georgia River group of mineral claims, 16 miles south of Stewart, on the Portland Canal, thus giving it three properties—viz., the Fish Creek, the Betty, and the Georgia. On the Georgia stripping already has started, and the orebody is reported to have been sampled with gratifying results.

Valhalla Prospecting Discloses Three Veins

John Willman, manager of the Kleanza company, states that the opening up of the Valhalla group, situated on Kleanza Mountain near the town of Usk, northern British Columbia, has disclosed three veins, on one of which a tunnel was driven 35 ft. last year, the sampling of which gave returns between $7.50 and $87 per ton. This year the company has been drifting on the same vein 1,800 ft. lower down. This now is about 27 ft. and, although no assays have been secured, free gold is said to have been disclosed from the portal to the face.

The Trona mineral group, three claims situated on Kleanza Creek, a branch of the Skeena River, also is showing up well with development.

The provincial government is extending substantial aid in the construction of roads to assist in the opening up of the Duthie properties near Smithers, B. C. The exceptional results obtained from shipments made to Trail, B. C., from this section have led to much mining activity in the district. The Cascade group is the latest prospect to attract attention. High-grade ore is reported to have been struck here, and a number of mining engineers have visited the property on behalf of eastern mining interests.

Riverside Developments Satisfactory

Frederic Keffer, consulting engineer, and Andrew Jackson, secretary of the Jack Paul Mining Co., of Spokane, Wash., recently inspected the company's property, the Riverside mine, near Rock Creek, Boundary District, B. C., and are reported to be well satisfied with the results of development. They are confident that their operations will lead to the blocking out of a large body of silver-gold-lead ore. The showings already are good, and the promoters believe that the Riverside is destined to become an important producer.

Betty O'Neal Mill Completed

THE Betty O'Neal Mines Co., of Battle Mountain, Nevada, reports construction work on the new 150-ton unit of the milling plant as being completed. It is planned to resume development work in places where it has been impossible in recent months to make any headway, due to shortage of labor and other conditions. Recent work has been concentrated on the No. 4 Tunnel level, 500 ft. above the Getchell haulage and drainage tunnel, at which elevation the Estella vein widens out to over 50 ft. and furnishes a convenient place easily to break ore. The new mill unit is now treating 100 tons of ore per day, the first unit being repaired.

Allenby Concentrator to Operate in a Few Weeks

H. S. Munroe, general manager of the Granby Consolidated Mining & Smelting Co., has announced that the Copper Mountain mine and the Allenby concentrator will be in operation and on a productive basis sometime between Sept. 15 and Oct. 1. The railway spur from Allenby to the mine is being cleared of several heavy landslides and other repairs effected along the line, at the mine and at the mill. There is plenty of ore at the mine to keep the railway and the mill at work for the present. Before this is exhausted newly mined ore will be delivered and the permanence of the industry would appear to be assured so long as the market holds. Regarding conditions at Anyox, Mr. Munroe stated that the repairs necessitated by the destruction of the powder magazine by fire, and the damage it caused to other parts of the plant, already were well under way and that the mine and plant at this point were working at full blast.

Ore Receipts at Trail Smelter

Ore receipts at the Trail Smelter, Consolidated Mining & Smelting Co., for the week ending July 21, were as follows:

Mine	Tonnage
Alamo, Alamo	41
Anna group, Slocan	6
Company mines	8,124
Hercules, Burke, Idaho	86
Iron Mask, Kamloops	54
Knob Hill, Republic, Wash.	55
Lone Pine, Republic, Wash.	160
Maestro, Ainsworth	4
Quilp, Republic, Wash.	164
Silverhoard, Ainsworth	5
Silversmith, Sandon	141
Wonderful, Sandon	35
Total	8,875

For the week ending July 31 the ore receipts at the same smelter were as follows:

Mine	Tonnage
Alamo, Alamo	39
Black Rock, Northport	78
Bosun, Silverton	13
Company mines	11,062
Cork Province, Zwicky	39
Florence, Princess Creek	103
Lone Pine, Republic, Wash.	225
Quilp, Republic, Wash.	219
Sally, Beaverdell	35
Silversmith, Sandon	177
Van Roi, Silverton, B. C.	42
Total	12,032

To Visit Kimberley Concentrator

Members of the Mining Association of Eastern British Columbia have arranged to meet at Cranbrook, B. C., on Aug. 9 to visit the Sullivan mine and the new mill at Kimberley. Afterward they will proceed by automobile to Windemere and will be received and entertained by R. Randolph Bruce, owner and manager of the Paradise mine.

Final Payment on Wellington Authorized

Final payment on the Wellington mine, Retallack, was authorized recently at a meeting of the Slocan Consolidated Silver Mines, Ltd., held at Nelson B. C. Approximately $20,000 has been spent on the purchase and the development of the Wellington since its acquirement by the present holders, practically all the amount being contributed by the directors and officers of the company. George H. Wieglanda, manager, recommended more development, and a further amount is to be subscribed to carry out this work. It is intended to complete a raise from the main tunnel level to a connection with the old upper workings, to stope out a fine body of clean galena ore opened last spring by a crosscut and drift on the 200-ft. level, to explore two stringers recently found in the main tunnel level containing high-grade ore, and to sink winzes on two oreshoots.

Armstead to Survey Utica Mine

Colonel H. H. Armstead, mining engineer, has become a resident of Kaslo, B. C. He is actively interested in several mining properties in that locality. He states that his intention is to make a thorough survey of the Utica mine, to determine what course to pursue in its further development.

WASHINGTON

Gladstone Mine Crosscutting

Crosscutting is in progress on the 200-ft. level of the Gladstone mine, near Northport, according to reports from Dan D. Dodd, superintendent. This depth was attained recently in operations started at 100-ft. depth.

The crosscut has entered soft ground. This may necessitate timbering as the crosscut proceeds, but it also has indicated the proximity of another chimney, believed to be the No. 8. The objective in the advance is the No. 9 chimney, the largest in the property developed to date. It is 140 ft. from the shaft, and contains a large tonnage of high- and medium-grade ores. The high grade is a sulphide in boulder form, containing 75 per cent lead and the medium grade a carbonate containing 20 to 30 per cent lead.

Bead Lake Starts Milling

The new mill of the Bead Lake Gold & Copper Mining Co., in the Newport district, has recently started operation. Some of the ore of the company was put through the mill last fall and the concentrates were shipped to the smelter at Midvale, Utah.

The mill has been remodeled, and will be operated entirely by electricity, the power being taken from the Calispel Light & Power Co.'s line that extends upriver from Usk. With the starting of the mill it is rumored that Newport will become the center of considerable mining activity, as the Bead Lake company expects to run steadily, and several other properties in the vicinity are now showing up strong.

Orphan Girl Resumes Operations

IT WAS officially announced that the Orphan Girl, one of the Anaconda properties located in the silver-zinc area on the west side of the Butte district, would resume operations this week, and that forty men will be employed. This crew will be enlarged as fast as conditions permit. This property has not been operated for more than two years.

IDAHO

Jim Blaine Crosscut Mineralized

The lower crosscut tunnel on the Jim Blaine property, on Pine Creek, in the Coeur de'Alene district, recently cut into a vein showing values in lead, zinc, and silver, according to word received in Spokane from the property. The tunnel has been driven over 800 ft. with a view of cutting both the Jim Blaine and Bristol leads, the latter at a point 1,400 ft. in the hill and at a depth of over 800 ft.

North Bunker Hill Near Main Tunnel Level

The crosscut in the North Bunker Hill property in the Wardner district is going ahead at a good rate and is now 315 ft. north from the main Drumm tunnel level, according to reports received at Spokane, Wash. An additional 75 ft. will be required to cut the vein on its dip. Several stringers have been passed in the last 50 ft. carrying values in lead and silver, one stringer showing considerable silver chlorides. The company has recently installed new electric equipment and is prepared to push the work ahead rapidly.

Sidney Mine Operations Gratifying

Development of the orebody recently uncovered in the lower workings of the Sidney mine, on Pine Creek, in the Coeur d'Alene district, has continued with gratifying results.

The ore shows a face of nearly 6 ft., part of which is clean shipping lead and zinc product. Drifts are now under way both to the east and west to determine the full extent of the shoot, while plans are to raise on the ore and connect with the upper levels.

The discovery of the ore at a depth of some 700 ft. below the upper workings proves the strength of the vein and is an important factor for the entire Pine Creek district in demonstrating the fact that the ores persist in the downward extension of the veins.

F. W. Callaway, who has the Sidney mine under bond and lease, has increased his crew at the mine and will push the development work along as rapidly as possible.

"Constitution Looking Good," Says Judge Turner

"Ore in the face of the tunnel of the Constitution Mining & Milling Co. is looking better than ever," said Judge George Turner, of Spokane, Wash., who returned recently from the property. There are twelve claims, nine miles up Pine Creek, in the Yreka district of the Coeur d'Alenes. It is about seven miles south of Kellogg.

"Samples of it run around 30 per cent zinc, 12 per cent lead, and 10 oz. silver. The lead and zinc separate readily, which was not true of the ore in the first three or four shoots nearer the tunnel entrance. We have much more of the ore in sight that is readily separable than that which is more difficult. However, even our most refractory ore can be easily handled now, owing to the great advance in selective flotation methods during recent years. One hundred tons of that ore will produce $1,000 a day.

"We are working ten men driving an adit, which is now 1,700 ft. long with six oreshoots in this distance covering a space of 1,200 ft. This development has been under way during the last year and has increased our ore reserves three times above what we had a year ago. We estimate that we have 350,000 tons in sight now."

Syndicate Mining Has Short Distance to Go

Reports from the property of the Syndicate Mining & Exploration Co., located near the mouth of Big Creek, along the county highway, in Shoshone County, are to the effect that the vein will be reached within the next 50 ft. at a vertical depth of over 700 ft. The lower crosscut has been driven 1,500 ft. to reach its objective through hard quartzite, all of the work being done by hand drills. The development of

the property will do much to prove up a new section in the Coeur d'Alenes, a territory lying north of the river and directly east of the Moon Creek mineral belt.

Silverado to Be Further Developed

The Silverado property, located east of the Yankee Boy and Polaris groups in the dry ore belt east of Big Creek, near Kellogg, will be further developed by a new corporation known as the Lincoln Mining Co., which has secured a bond and lease on the well-known group of claims. M. L. Savage, of Kellogg; Herman J. Rossi, Franklin Pfirman, and W. H. Newton are the promoters of the corporation, and supervision of the development work will be under the direction of Mr. Newton, for five years manager of the Yankee Boy.

The Silverado tunnel has been driven 4,800 ft. to the Polaris vein system and is now to be continued an additional 300 ft. to cut the Yankee Boy lead on its eastern extension. The recent strike of high-grade ore in the lower workings of the Yankee Boy practically insures extensive orebodies at depth in the extensions of the vein, and the work outlined in the Silverado will prove the connection between the Big Creek district and the Argentine and Galena to the east.

UTAH

Work at Tintic Drain Tunnel Progressing Well

The work which was resumed a few months ago at the Tintic drain tunnel in the Tintic district of Utah, after a long period of inactivity, is progressing satisfactorily. The tunnel—in 6,280 ft. at the time of resumption of operations—has been advanced 200 ft. This project was started several years ago by Jesse Knight, to supply water for agricultural purposes, to develop a large mineral tract, and then to drain the southern end of the Tintic district. The tunnel has still a long distance to go before this interesting work can be completed, and the project will take time and money.

Iron King Makes Promising Strike

A recent strike at the Iron King mine at Eureka, Utah, has been the subject of considerable interest. Developments, however, have not gone far enough to determine the value of the find. The fissure in which the ore was encountered has been followed 100 ft., and a low-grade orebody has been opened, and along with it there is considerable high-grade ore. Work is being done on the 1,565 ft. level, 1,700 to 2,000 ft. northeast of the shaft. The Iron King is mining 50 tons of fluxing iron ore daily.

Ray Hercules Yields to Adverse Conditions

THE Ray Hercules mine, at Ray, Ariz., has suspended operations and the fifty men that were employed have been laid off. It is reported that inability to secure adequate electric power is the reason for the shutdown. This company was only recently reorganized and development and repair work was begun at the mine early this summer, in preparation for a general resumption of mining.

MICHIGAN

July Copper Shipments Fall Off

There was a sharp falling off in copper shipments by water from the Michigan docks in July, only 5,536,000 lb. being moved, compared with 9,678,000 in June. From the dock of the Michigan smelter at Houghton, which treats Copper Range, Mohawk, and Wolverine copper, 642,000 lb. was shipped; Quincy shipped 570,000 lb.; and 4,224,000 lb., representing the metal of Calumet & Hecla and subsidiaries, went forward from the docks at Torch Lake. Calumet & Hecla also shipped 100,000 lb. from its storage supply at Dollar Bay. Total boat cargoes, however, do not represent the entire total of metal moved, for several million lb. were taken out by rail to mid-west points.

Hecla Will Continue Dividends

THE Hecla Mining property, recently destroyed by fire, will continue to pay dividends while the property is being put in condition for operation, according to reports received at Spokane, Wash. Reconstruction work has started and it will be at least a year before the mine is in operation. During this time regular dividends will be paid to stockholders from the $1,000,000 "occupancy and use" policy. A $350,000 fire insurance payment will be used in the work of reconstruction.

July Copper Production

Refined copper production for the month of July in the Michigan district was 11,550,000 lb., compared with 10,975,000 lb. in June. July figures, estimated, are as follows: Calumet & Hecla, 4,300,000 lb.; Ahmeek, 1,700,000; Copper Range, 2,400,000; Isle Royale, 800,000; Mohawk, 1,000,000; Quincy, 1,000,000; and Wolverine, 350,000.

Seneca Officials to Inspect Property

The board of directors of Seneca Copper corporation is expected in the Michigan district the latter part of August, coming for the purpose of inspecting the property and settling certain details in connection with the start of regular production, now near at hand. It is expected Seneca will hoist more than 1,000 tons or rock daily at first, increasing this tonnage when operations get well under way.

Gold Dust Mill Contract Let

A CONTRACT has been awarded to E. H. Kennard and H. E. Bierce, of Kingman, Ariz., for the construction of a fifty-ton mill at the Gold Dust mine. Previous satisfactory developments and the recent strike of high-grade gold ore at this property have made advisable the construction of a concentrator. The plant will have provisions that will allow for making additions and increasing the capacity if developments warrant.

NEVADA

Tonopah Cyanide Plant to Close

The Tonopah-Belmont Development Co. has definitely decided to close its Tonopah 500-ton milling cyanide plant and ship its limited tonnage to the Millers plant of the Tonopah Mining Co. Mine production will likely not exceed 100 tons per day, although developments will naturally govern production. The company plans to continue regular development work and the announcement regarding future plans states that the Tonopah mill will be reopened whenever ore reserves justify such action. The Belmont mill, the latest word in Tonopah metallurgy, was constructed in 1911 and 1912 and has been operating continuously since.

Gypsy Queen shaft repair is complete to the 1,300 level, leaving only 200 ft. to be repaired before sinking can be started. Water level is at the 1,320-ft. point, but flow is small and can easily be taken care of by bailing, so no particular trouble is anticipated in unwatering the shaft and resuming sinking. The Gypsy Queen shaft and a large part of the company holdings are leased to the Montana Tonopah Co.

Gold Canyon Dredge Being Moved

After much delay the steel dredge of the Gold Canyon Dredging Co., which has been operating in Gold Canyon, between Silver City and Dayton, is being dismantled and the machinery and hull moved to a California property of the same company. The dredge has a capacity of 7,500 yd. of gravel daily. No data on operations is available, but it is generally believed that operating conditions, due to large boulders and unsatisfactory bedrock, were difficult and costly, and that the enterprise was not a profitable one.

Red Hill Florence Shaft Sinking

The Red Hill Florence Mining Co. is again sinking its shaft near Gold Circle. Shaft sinking was delayed at the 310-ft. point due to water, but pumping and bailing equipment has been added and no further trouble is anticipated in sinking to the 500 level, where lateral work is planned. Gross value of present ore reserves above the 270 level is estimated as $800,000, and if the ore persists to the 500 level ore reserves will be more than doubled.

THE MARKET REPORT

Daily Prices of Metals

Aug	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
9	14.00	38.50	38.875	6 525	6 45	6.15
10	.....	.....	.....	.....	.....	.....
11	13.875@14.00	38.375	38.75	6.525	6.40@6.45	6.20
13	13.875	37.875	38.25	6.525	6.40	6.25
14	13.75@13.875	38.00	38.375	6.525	6.40	6 25@6.30
15	13.75	39.00	39.375	6.525	6 40	6 30@6.40
Av.	13.875	38.350	39.725	6 525	6.415	6.245

*These prices correspond to the following quotations for copper delivered: Aug. 9th, 14.25c.; 11th, 14.125@14.25c.; 13th, 14.125c.; 14th, 14.00@14.125c.; 15th, 14.00c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Aug.	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
9	64 5/8	65 1/4	70 1/2	184 3/4	185 1/2	24 1/8	23 7/8	31 5/8	31
10	64 1/4	65	70	183 3/4	184 3/4	24	23 3/4	31 1/2	31
13	63 7/8	64 5/8	69 3/4	182 1/4	183 1/2	24 1/8	24	31 1/2	31
14	63 5/8	64 1/2	69 1/2	183	184	24	23 7/8	31 3/4	31 1/4
15	63 3/4	64 1/2	69 1/4	184	185 1/4	23 7/8	23 3/4	31 7/8	31 3/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver New York	Silver London	Gold London	Aug.	Sterling Exchange "Checks"	Silver New York	Silver London	Gold London
9	4.56 1/4	62 3/4	30 11/16	90s 4d	13	4.56 5/8	63 1/8	31 1/16	90s 2d
10	.....	....	31	90s 2d	14	4.56 5/8	63 1/4	31 1/16	90s 2d
11	4.56 1/4	63	31 1/8	.....	15	4.56 1/2	63 1/8	31 1/16	90s 2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Aug. 15, 1923

No startling developments have been in evidence in the non-ferrous metal market during the week, business in general being on about the scale that would be expected at this time of the year. All places of business were closed on Friday, the day of President Harding's funeral, and there was also little activity on Saturday. Copper buyers are still hard to find, and the price has receded farther, having now reached 14c. delivered. Zinc is perceptibly firmer and sales have been good, despite the increase in stocks last month. Lead and tin have been extremely inactive, though prices are firm.

Copper

Some copper was sold for 14.25c. delivered on Thursday, but since then it has been possible to do better than this. Consumers remain disinterested, though one or two good orders were placed this week at 14⅛c. Yesterday a fair amount of business was done at that level, but it was also possible to obtain the metal for 14c. from one or two directions, and the same condition also exists today. Those willing to sell at the even figure report no great demand even at that level, though they feel that the price may be stabilized there for a time. This feeling was also expressed when the market hit 15c., a price which was passed without any hesitation at all; it is to be hoped that 14c. will prove more of a stumbling block, but unless more buying appears there seems no reason why the decline should not continue. Certainly European conditions are not encouraging, and domestic brass manufacturers do not seem very optimistic over the condition of their fall trade. At present the larger producers are much more willing to meet the market than they were a few weeks ago, and a reputable consumer, if he wanted a few million pounds at 14c. today, would probably find half a dozen selling agencies willing to accommodate him.

The foreign demand during the last week has been poor, with competition active. The pressure to sell abroad, in lieu of domestic outlets for copper, has frightened off buyers, who feel that declining prices are probable.

Forward deliveries in the domestic market are nominally the same as prompt, though for shipment as late as November and December there is less of a tendency to quote a rock bottom price.

Lead

The official price of the American Smelting & Refining Co. continues at 6.50c., New York.

The lead market has been extremely quiet all week, and one of the leading producers reported that he had not even had an inquiry for delivery in the New York district in the last three days. Fortunately, there is no pressure to sell; in fact the producers have practically nothing to offer for shipment before September and are perfectly satisfied to remain out of the market for the next two or three weeks. Spot and prompt lead has been sold in small lots at about 6.75c., but the amount of this business is exceedingly small compared with the tonnage that is going to consumers at the 6.50c. figure.

In the St. Louis and Chicago markets there has been more activity than in the East, but sales have not been large. There seems no great difficulty in getting lead at 6.40c. now, and a sale of Federal lead at 6.35c. yesterday is rumored, though not confirmed. Inquiries were out today for 500 tons of corroding lead for Chicago delivery, and it is probable that this grade can be obtained for around 6.60 or 6.65c., Chicago.

Zinc

Sales of zinc have been very satisfactory during the week, both galvanizers and dealers buying moderate tonnages, largely for August or September shipment. Slight premiums are being asked for later deliveries, though they have not been in great demand in the last few days. Consumers are not bought ahead, but seem willing to wait and to a large extent buy the metal as they need it. The statistics released by the American Zinc Institute show: Stock on hand July 1, 17,173; produced in July, 43,065; shipped in July, 38,998; stock on hand July 31, 21,240; amount shipped from plant for export during July, 185 tons; number of retorts operating, July 31, 82,075. Though this report indicates an increase in stocks of slightly over 4,000 tons, this is rather more favorable than was expected, considering the inactivity in the zinc trade of the last month or two. Producers in the Tri-State district are continuing in their restrictive policy, so that ore prices are firmer at about $37.50, with $38 probable. Smelters complain that if they banded together for a similar purpose, Washington would lose no time in taking notice of it. To make business at all profitable, smelters say they are compelled to reduce wages, 10 per cent reductions having been posted at several plants. Strike threats are the result, and these are also conducive to a probability of decreased production and a consequent firmer market. European prices are holding up well considering the disorganized conditions obtaining there, and it is not at all unlikely that exports from this country may soon take place. English galvanizers are reported more active with orders from India. All in all, the zinc market seems in particularly good position just now.

Tin

Prices are somewhat stronger, but there has been little interest on the part of consumers. The market fluctuated widely from 38⅜ to 38⅞c. yesterday, but actual business was exceedingly small. Prices for forward deliveries are the same as those for spot.

Arrivals of tin, in long tons: Aug. 1st, Java, 100; 11th, Straits, 80; China, 10; 13th, Liverpool, 120; China, 100; Straits, 790; Australia, 5; 14th, Straits, 450; China, 25; total so far in August, 3,315.

Foreign Exchange

European exchanges have been generally weak, as is to be expected with present conditions there. On Tuesday, Aug. 14, cable quotations on francs were 5.5175c.; lire, 4.31c.; and Canadian dollars, 2 3/4 per cent discount.

Silver

Buying in London and New York for Indian bazaar account advanced prices during the week, and although the market is somewhat quieter at the close, the tone is steady.

Mexican Dollars—Aug. 9th, 47⅞; 11th, 48; 13th, 48⅛; 14th, 48¼; 15th, 48⅛.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 26@27c. per lb.; 98 per cent, 25@26c. London, £115, 98 per cent.

Antimony — Chinese and Japanese brands, 7⅞@8c. W.C.C. brand, 8½c. Cookson's "C" grade, 10@10.50c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1 per lb. London, 4s. 6d.

Cobalt—$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £130 per long ton.

Palladium—$80 per oz.

Platinum—$116 per oz. London, £24 15s.@£25.

Quicksilver—$65 per 75-lb. flask. Quiet. San Francisco wires $65.35. London, £9 5s.

The prices of Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium, and **Tungsten** are unchanged from prices given Aug. 4.

Metallic Ores

Chrome, Iron Ore, Magnetite, Manganese, Molybdenum, Titanium, Tungsten, Vanadium, and **Zircon Ore** are unchanged from the quotations published Aug. 4.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 11—Zinc blende, per ton, high, $40.85; basis 60 per cent zinc, premium, $38@$38.50; Prime Western, $37@$37.50; fines and slimes, $36@$34.50; average settling price, all zinc ores, $36.02.

Lead, high, $82.05; basis 80 per cent lead, $75@$80; average settling price, all grades of lead, $78.36 per ton.

Shipments for the week: Blende, 9,887; lead, 698 tons. Value, all ores the week, $409,460.

Production continues to be restricted, with some of the larger mines idle, and most of those in operation outputting only five days a week. The output is variously estimated at 7,500 to 9,500 tons per week, about equal to average purchases. While beneficially affecting the zinc ore situation, the restricted output is seriously curtailing the production of lead ore, with shipments less than 50 per cent normal.

Platteville, Wis., Aug. 11.—Blende, basis 60 per cent zinc, $42.50 per ton. Lead, basis 80 per cent lead, $72 per ton. Shipments for the week: Blende, 440 tons; lead, 30 tons. Shipments for the year: Blende, 19,788; lead 490 tons. Shipments for the week to separating plants: 398 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $375@$500; No. 2, $225@$325; spinning fibers, $150@$225; magnesia and compressed sheet fibers, $100@$150; shingle stock, $55@$60; paper stock, $35@$45; cement stock $20@$25; floats, $9@$12. All f.o.b. mines, per short ton, Quebec.

Barytes, Bauxite, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, Talc and Tripoli are unchanged from the Aug. 4 prices.

Mineral Products

Arsenious Oxide (white arsenic)—9@9½c. per lb., delivered over the balance of the year. Inquiry beginning.

Copper Sulphate—5.25@5.45c. per lb., domestic product.

Sodium Nitrate—$2.45 per 100 lb., ex-vessel, Atlantic ports.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of Aug. 4.

Ferro-Alloys

Ferrosilicon—50 per cent, $85.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices published Aug. 4.

Metal Products

Copper—Sheets, 22.75c. base; wire, 16.75c.

Nickel Silver—18 per cent Grade A sheets, 28.75c.

Yellow Metal — Dimension sheets, 20.00c.; rods, 17.00c.

Lead Sheets and **Zinc Sheets** are unchanged from the prices given in the Aug. 4 issue.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the Aug. 4 prices.

The Iron Trade

Pittsburgh, Aug. 14, 1923

Forecasts of large decline in steel production in July proved erroneous, the average rate of ingot production being only 2½ per cent under that of June. No price declines have occurred in the leading finished steel products.

With the final adoption of 1924 models by nearly all the automobile factories much tonnage has been released. A slight decline in demand for oil-country tubular goods is balanced by heavier movement in merchant pipe.

Pir Iron—Though there are reports of price cutting, the market as a whole seems to be unchanged at $26.50 for bessemer, $25 for basic and $25 to $26 for malleable, f.o.b. Valley or Johnstown, with $1.77 freight to Pittsburgh. Demand has been increasing slightly but is still far below production, which is decreasing.

Connellsville Coke—Furnace coke has recovered from its slump of a fortnight ago. Spot furnace, $4.50; contract furnace, $4.75@$5; spot foundry, $5.25@$5.50.

COMPANY REPORTS

St. John Del Rey Mining Co., Ltd.

Gold; Brazil

A report of operations of St. John Del Rey Mining Co., Ltd., for the year ended Feb. 29, 1923, shows a profit of £148,823, as follows:

Gold, twelve months to Feb. 28, 1923, as par value	£475,022	
Silver, twelve months to Feb. 28, 1923	4,152	
	£479,174 (a)	
Premium realized on sale of gold	38,916	
	£518,090	
Less government duties and transport charges	13,484	
		£504,606
Working cost in Brazil	£336,261 (b)	
Developments in the mine	6,702	
London expenses, including directors' percentage (less interest and transfer fees)	12,820	
		355,783
		£148,823
Amount brought forward from last account		40,671
		£189,494
Interim dividends on the preference and ordinary shares, paid Dec. 20, 1922	£27,226	
Proposed final dividends, on preference and ordinary shares, payable June 29, 1923, making 10 per cent preference shares, and 10 per cent per annum, less tax, upon the ordinary shares	40,808	
Proposed bonus of 6d. per share on ordinary shares for the year ended Feb. 28, 1923	13,657	
Balance of income tax and corporation profits tax	5,884	
		87,575
		£101,919
Transferred to capital works account	£60,000	
Balance carried forward	41,919	101,919

(a) 60s. 10¼ d. per long ton crushed. (b) 42s. 8½d. per long ton crushed.

The tonnage crushed was less than that of the preceding year by 9,700 tons and the bullion realized £45,620 less, taking gold at its par value. There was also a heavy decline in the premium on gold, the amount received being £38,916, compared with £121,358.

Labor was scarce and expensive, with the result that working cost was high in spite of the low rate of exchange, which averaged 6.946d. per milreis for the company's drafts and is the lowest recorded for many years.

In consequence of the fall in the premium and of the other causes indicated above, the profit for the year shows a reduction of £108,401, compared with the exceptionally large profit obtained in 1921-22, but the amount realized, £148,823, is well up to the average of recent years.

The balance brought forward from last year was £40,671, making with the present profit a total of £189,494, out of which an interim dividend of 9d. a share has been paid on the ordinary shares. The directors now recommend the usual final dividend of 1s. 3d. a share, less tax, making 10 per cent for the year on the ordinary shares, and in addition a bonus of 6d. a share, less tax, on such shares. It is proposed to transfer £60,000 to capital works account and to carry forward the balance of £41,919.

The supply of labor at the mine has recently improved, and it is hoped to obtain an increased tonnage during the current year. Every effort is being made to reduce cost, which may be seriously affected if exchange should rise rapidly.

The reserves of ore at the end of the year were estimated at 1,381,424 tons, which are sufficient to provide a full output for seven years. A favorable indication of the present quality of the lode is afforded by the assay value of the mineral from the main lode during the last year, which was 64s. 8d. per ton, and may be compared with 60s. 5d., the average for the four preceding years.

Since the close of the year the "I" shaft has reached the working at horizon "23," at a vertical depth of 6,726 ft. below the surface. An orebody was discovered at this horizon which, from its size and value, appears to be the Gamba lode. It is expected that the main lode will be reached south of the present explorations.

Alaska Treadwell Gold Mining Co., Alaska Mexican Gold Mining Co., Alaska United Gold Mining Co.

Since the last annual report, the Treadwell Yukon Co., Ltd., has been legally domiciled for operating in both Yukon Territory and in Alaska, and all outstanding options have accordingly been transferred to it.

MAYO VENTURE

Options.—The purchase of the several mining claims now being developed was provided for by optional instalment payments over four years' time that expires near the end of 1925. These payments total $458,000, and $112,000 of this amount has already been paid. In addition to the optioned property, the company holds some fractional mining claims and also some Mayo waterfront property.

Development.—This work has continued with satisfactory results. No. 1 shaft has been sunk on the dip (55 deg. to 70 deg. from the horizontal) of the main vein for a distance of 300 ft., at which depth the 300 level was started in the vein on ore of average grade; but the driving of this level was stopped last January by a heavy flow of water that the present pumps could not handle. However, a drainage tunnel has been planned for, which in a length of 2,500 ft. will cut the vein at a vertical depth of 500 ft.

No. 2 shaft, 400 ft. southerly from No. 1 shaft, has been sunk to a depth of 100 ft., on the dip of the main vein, and connecting levels have been driven between the two shafts at depths of 50 and 100 ft. The 200 level has been driven entirely from No. 1 shaft, and crosscutting and a raise have served to connect No. 2 shaft with this level.

Ore.—There are several fissures crossing the main vein, and at such intersections orebodies occur of dimensions that have not yet been fully determined, but the underground work has so far developed two orebodies estimated to contain, above the 200 level and between the two shafts, a total of 40,000 tons of an average assay value of 93.4 oz. silver, 10 per cent lead, 12 per cent zinc and about 25c. gold per ton. From the ore thus developed, 4,000 tons of an average assay value of 230 oz. silver, 36 per cent lead, 12 per cent zinc and 60c. gold per ton has been selected, sorted, and sacked for shipment. This sacked ore has been hauled to Mayo on the Stewart River, from which point it will be shipped to the Bunker Hill smelter, in northern Idaho.

With silver at 60c. per oz. and lead at 6c. per lb., this shipping ore has a gross value of $175 per ton, and should yield $100 per ton over and above all freight, smelting, and tariff charges from Mayo to and through Bunker Hill smelter to market. The cost of developing, mining, sorting, sacking, and delivering ore to Mayo has been about $50 per ton, leaving a net operating profit of $50 per ton of shipping ore; and it is estimated that about 6,000 tons additional can be selected and sorted for shipment from the ore remaining between No. 1 and No. 2 shafts and above the 200 level. The ore left in the mine and on the dumps after all the shipping ore has been removed should, according to present information, have an average assay

value of about 47.8 oz. silver, 1.3 per cent lead and 12 per cent zinc per ton.

At a point 800 ft. southerly from No. 2 shaft, sinking of No. 3 shaft has been started on the main vein in ore of average grade; and 1,400 ft. southerly from No. 2 shaft, on an adjoining property, at a point 200 ft. within such property from the boundary line, a shaft is being sunk on the same main vein and is finding about the same average grade of ore. The claims under option cover the strike of the main vein for a length of 4,000 ft. northerly from above-mentioned boundary line and along the first 1,660 ft. of this length ore has been exposed by shafts 3, 2, and 1 and by several surface trenches.

NIXON FORK VENTURE

The mill started May 29 last year and operated until Oct. 4, when the freeze-up closed it down for the winter. During the interval 2,433 tons were milled, yielding gold bullion to the amount of $114,024.22. The mill resumed crushing as soon as the thaw came, and it is expected that all the remaining developed ore will be mined out and milled this season. As the development work last year found no additional ore, this venture will result in a loss.

The receipts and expenditures and assets and liabilities of the respective companies follow:

Alaska-United Gold Mining Co.

Receipts		
Profits from operating Ready Bullion mine	$85,922.84	
Refinery and cyanide plant clean-up	3,758.21	
Expenditure		
Refinery and cyanide plant clean-up	$667.62	
Miscellaneous	16,035.96	
Nixon Fork venture { Covered by shares in Mayo venture { Treadwell Yukon Co., Ltd. }	11,410.46 36,678.17	
Miscellaneous	16,035.96	
		64,792.21
Surplus of all receipts over all expenditures		$31,212.05
Assets (exclusive of property and plant)		
Cash	$3,832.10	
Bonds	99,751.25	
Treadwell Yukon Co., Ltd., stock	91,421.20	
Sundries	11,704.24	
		$206,708.79
Liabilities		
Alaska Treadwell Gold Mining Co.		$344,572.38
Borrowed at 5 per cent. Leaving an excess of liabilities over assets (exclusive of property, plant and 20 per cent interest in joint utilities and Shakan) of		$137,863.59

Alaska-Treadwell Gold Mining Co.

Receipts		
Interest	$86,333.84	
Refinery and cyanide plant clean-up (our proportion—44.48 per cent.)	13,855.74	
Miscellaneous	$18,866.12	
		$119,055.70
Expenditure		
Refinery and cyanide plant clean-up	$2,907.55	
Joint utility improvements	2,227.10	
Shakan prospect	582.17	
Nixon Fork venture { Covered by shares in Mayo venture { Treadwell Yukon Co., Ltd. }	34,231.29 110,033.71	
Miscellaneous	$28,240.50	
		178,222.32
Excess of all expenditures over all receipts		$59,166.62
Assets (exclusive of property and plant)		
Cash	$25,457.72	
Bonds	1,218,544.02	
Bonds	1,019,344.81	
		$2,263,346.55
Liabilities		
Accounts payable	$45,481.37	
Personal accounts, D.I.	21,419.04	
		66,900.41
Surplus of assets over liabilities (exclusive of property, plant and 60 per cent interest in joint utilities and Shakan) of		$2,196,446.14

Alaska-Mexican Gold Mining Co.

Receipts		
Interest	$6,629.70	
Refinery and cyanide plant clean-up	3,737.44	
Commercial profits	3,785.33	
		$14,152.47
Expenditure		
Refinery and cyanide plant clean-up	$636.14	
Douglas Island—general expense	2,349.21	
Miscellaneous	5,900.93	
Additions to joint utilities	311.17	
Sundry adjustments	14.80	
Nixon Fork venture { Covered by shares in Treadwell Yukon Co., Ltd. }	11,410.45 36,678.16	
		$57,300.66
Excess of all expenditure over all receipts		$43,148.19

Assets and liabilities of Alaska Mexican Gold follow:

Assets (exclusive of property and plant)		
Cash	$1,446.92	
Bonds	119,125.00	
Treadwell Yukon Co., Ltd., Stock	91,421.20	
Sundries	10,802.43	
		$222,795.55
Liabilities		
Alaska Treadwell Gold Mining Co.		$22,335.98
Surplus of assets over liabilities (exclusive of property, plant and 20 per cent interest in joint utilities and Shakan) of		$200,459.57

General Prospecting.—The Treadwell Yukon Co., Ltd., has secured an option on the Tulsequah prospect discovered last fall in northern British Columbia, about 50 miles from Treadwell, on the Tulsequah River, a branch of the Taku River. Trenching for a width of 24 ft. across the outcrop showing on this prospect, indicates an average assay value of $6 gold and 14 oz. silver per ton, with some appreciable occurrences of lead, copper, antimony, and zinc.

The option agreement provides that the purchase price of $75,000 for a 98 per cent interest in the property, may be paid for from certain percentages of the gross amounts recovered when and as the ore is mined and treated. The remaining 2 per cent interest in the property was retained by the original discoverers and owners.

The operation of the Ready Bullion mine, on Douglas Island was finally discontinued last December, and a complete and final clean-up of the cyanide plant is now being made.

Butte and Superior Mining Co.

Zinc, Copper; Butte, Mont.

A report of Butte & Superior Mining Co. for the quarter ended June 30, 1923, shows a deficit of $60,085 after expenses, taxes, and depreciation, but before depletion. This compares with surplus of $102,827 earned in the previous quarter and deficit of $66,845 in the corresponding period of 1922.

Statement for the quarter ended June 30, 1923, compares as follows:

	1923	1922
Net value metal in concentrates	$898,992	$651,077
Miscellaneous income	20,043	32,002
Total income	$919,035	$683,079
(a) Expenses, depreciation and taxes	979,120	749,924
Deficit	$60,085	$66,845

(a) Includes shutdown expense.

No provision has been made in the above statement for depletion.

Income from operations during second quarter was reduced by decline in prices of zinc and lead and suspension of Pittman Act. Costs were increased by advance in wages of 50c. a shift for all classes of labor, effective March 15. Mining and milling costs for quarter were high, due to expense and delays on account of shaft repairs and cost of investigation of improved metallurgical processes. These additional costs were partly offset by returns from increased copper shipments.

Operating economies effected and improved metal prices will result in a better showing for third quarter, in the opinion of President Jackling.

Total copper in ore produced during second quarter was 1,126,023 lb., which compares with 700,283 lb. for first quarter. Average price realized for copper during second quarter was 15.251c. per lb. and during first quarter 15.454c.

Total zinc in concentrates produced during second quarter was 20,058,072 lb., which compares with 22,135,017 lb. for the first quarter. Average price realized for zinc during second quarter was 6.502c. per lb., while price realized during first quarter was 7.34c. Average price realized for lead during second quarter was 7.376c. per lb. and during first quarter it was 8.12c. Price realized for silver during second quarter was 82.339 per oz., while during first quarter it was 99.625c. per oz.

Development done during second quarter consisted of 4,000 ft. of drifting and crosscutting, 1,333 ft. of raises, and 125 ft. of station cutting and shaft raises. Development on various levels of copper vein continued with satisfactory results.

Imports of Ores and Metals, June, 1923 and 1922

In Pounds

	June, 1922	June, 1923
Antimony		
Ore	.....	305,903
Metal, matte and regulus	510,120	1,168,775
Copper		
Ore	4,858,839	4,341,019
Concentrates	1,930,425	2,912,880
Regulus, coarse metal and cement copper	1,386,616	39,400
Total	8,175,880	7,293,299
Imported from:		
Spain	274,000	510,820
Canada	519,293	197,894
Mexico	135,559	1,934,156
Cuba	.....	1,134,880
Chile	4,214,393	2,745,270
Colombia	270	.....
Peru	67,365	356,228
Other countries	2,965,000	414,051
Unrefinied black, blister and converter copper in pigs and bars	14,596,714	46,540,898
Imported from:		
Canada	5,137,434	5,129,001
Spain	.....	371,987
Mexico	3,724,190	10,015,435
Chile	.....	18,684,401
Peru	5,735,090	7,021,813
Portuguese Africa	.....	3,784,379
Other countries	.....	1,533,882
Refined copper	27,473,805	10,348,894
Old and clippings for remanufacture	848,186	493,198
Composition metal, copper chief value	.....	66,000
Copper manufactures	.....	13,626
Brass		
Old and clippings for remanufacture	11,193,417	2,884,200
Manufactures of brass	.....	60,097
Lead		
Ore and matte	537,391	4,878,089
Bullion or base bullion	3,002,796	14,347,988
Pigs, bars, other forms and old	17,956	4,028,725
Manufactures of lead (except type metal)	.....	32,595
Manganese ore, long tons { Free	44,329	.....
Manganese ore, long tons { Dutiable	.....	36,138
Pyrites, long tons	9,414	26,007
Tin		
Tin ore	887	11
Tin in bars, blocks and pigs	12,552,329	10,996,478
Imported from:		
United Kingdom	1,626,395	987,709
British Straits Settlements	10,048,657	7,475,820
Dutch East Indies	851,523	913,994
HongKong	.....	876,378
Australia	22,400	35,840
Other countries	3,354	706,737
Tungsten ore, long tons { Free, tons	280	.....
Tungsten ore, long tons { Dutiable, pounds	.....	.....
Zinc ore (dutiable)	143,777	8,472
Zinc in blocks and pigs (dutiable)	37,500	382
Zinc dust (dutiable)	.....	5,227

Lead and Zinc Scarce in French Metal Market

SPECIAL FOREIGN CORRESPONDENCE

Paris, Aug. 2—The market is very quiet on the whole, and particularly so far as copper and tin are concerned. Disposals are scarce in lead, and the industrial demand is improving for zinc, especially for galvanized products, while the importation is not increasing. Transactions with the Continent are prevented by the dockers' strike in England. The situation is unchanged regarding French non-ferrous ores.

In 1921, France took about one-ninth of the world's copper production. Two-thirds of her imports in copper are supplied by the United States, whereas her imports from Great Britain are only one-seventh of the tonnage from the States, and Chile scarcely reaches one-third of the tonnage imported from Great Britain. France's Algerian mines are supplying only 3,000 to 4,000 metric tons a year; an appreciable tonnage in ore could be got from Congo, should the means of transportation be adequate.

Business in copper is very quiet, not only because of the lack of confidence resulting from the political situation, but also on account of the holiday period. Only small transactions are being made, and these are only for immediate deliveries and to meet the most essential needs.

The substitution of aluminum for copper is being tested extensively in France, where considerable production of this metal is being made out of bauxite, of which France possesses important mines. The experiments in the substitution of aluminum wire (with a steel wire inside) for that of copper wire have been satisfactory. In such a case, the weight of the necessary aluminum is equal to half of the weight of copper. In spite of the higher price for aluminum, its utilization means a saving of 40 per cent and thus prevents from buying copper on foreign markets with the depreciated French money.

The situation is exactly the same for tin as for copper—only a few sales are made. There is great shortage in lead and zinc; not that the demand for industry has improved in the least but due to the scarcity of disposals. The decrease of the output of zinc in Belgium, and strikes, both in England and Spain, prevent French importation of these metals. Arrivals of Mexican lead are slack so that only a few American lots are sold. A representative of a well-known British firm has said that he was ready to buy any available quantity of lead on the market to fill all his customers' requirements, but for immediate delivery or at the beginning of September.

In a general way, the feeling for the future is rather optimistic in zinc. London prices are increasing and Paris prices are raised accordingly. French disposals are very scarce now and quite insufficient to meet the even low demand, due to the fact that all supplies stored in France during the war are now exhausted; that French output is not yet very important; and that Belgium is producing only 60 per cent of her capacity.

Demand is reviving in iron ore, as is the output for pig iron. In South Wales, the experiments being continued for Briey ore are satisfactory. French exports to Scotland and Cleveland have come to a stop. The average price of Briey iron ore (35 per cent iron) is 15@15 fr. a metric ton, at the mines; Algerian ore (50 per cent Fe; 8 per cent Si), is quoted 35 fr. a metric ton. New openings have been resumed for exports of calcined ores, both in South Wales and Scotland, and a few contracts have been placed.

As imports of American coke and coal have stopped, there cannot be any further question of exporting French iron ore to America, but this subject is being discussed and should be pursued actively, if, as is to be feared, French imports of American minerals should have to be resumed soon.

Exports of Copper, Lead and Zinc, June, 1923 and 1922

In Pounds

	June, 1922	June, 1923
Copper		
Ores, concentrates, matte and regulus (copper content)	7,357	4,712
Copper and manufactures of (total)	66,374,734	63,184,952
Refined, in ingots and bars:		
Exported to		
Belgium	3,033,438	5,387,687
France	11,280,279	15,158,471
Germany	14,144,238	9,041,442
Italy	3,656,397	3,588,027
Netherlands	4,289,230	638,951
Spain	1,439,243	280,301
Sweden	1,918,002	1,740,081
United Kingdom	10,319,933	13,469,388
Canada	184,744	606,992
China	6,722,360	4,390,515
Japan	1,220,658	675,254
Other countries	523,619	755,182
Old and scrap	211,370	418,854
Composition metal, copper chief value	4,592	3,622
Pipes and tubes	97,398	203,727
Plates and sheets	360,128	470,612
Wire, except insulated	976,012	873,555
Insulated wire and cable	631,646	809,458
Lead		
Pigs and bars:		
From domestic ore	336,881	1,124,055
From foreign ore	684,107	3,133,500
Exported to:		
France	.....	1,344,321
Germany	.....	940,992
Netherlands	.....	504,182
United Kingdom	392,217	728,374
Other Europe	.....	56,084
Argentina	.....	18,074
Brazil	448,115	488,854
Other countries	180,656	176,674
Zinc ore, concentrates and dross	1,099,292	756,505
Spelter:		
From domestic ore	9,208,199	1,179,287
From foreign ore	650,008	1,122,022
Total zinc, slabs and blocks, etc	9,858,207	2,301,309
Exported to		
Belgium	418,760	.....
France	1,948,913	1,624,132
United Kingdom	4,366,926	672,030
Canada	169,334	1,728
Japan	1,008,064	.....
Other countries	1,946,210	3,419
In sheets and strips	573,174	980,546
Other zinc manufactures	113,797	121,509
Zinc dust	340,238	503,413

MINING STOCKS

Week Ended August 11, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	60	60	60	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	....	....	1⅛	....	....
Alloues	Boston	*17	*15	*15	Mar. '19	1.00
Anaconda	New York	40⅜	38⅛	39⅛	Je. 16, Jy. 23	0.75
Arcadian Consol.	Boston	2	1⅞	1⅞	....	....
Ariz. Com'l	Boston	9⅛	9⅛	9⅛	July '23,	0.50
Calaveras	N. Y. Curb	....	....	2	....	....
Calumet & Arizona	Boston	48	47½	47½	June '23,	1.00
Cal. & Hecla (New)	Boston	42	40	40½	June '23, Q	10.00
Centennial	Boston	8½	8	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	39⅜	38	38½	Jy. 19, Au. 1	1.00
Chile Copper	New York	26⅛	25⅞	26	Se. 1, Se. 29, Q	0.62½
Chino	New York	18	16½	17	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb	2¼	⅞	2¼	....	....
Copper Range	Boston	27	27½	27⅛	May '23, Q	1.00
Crystal Copper	Boston Curb	*60	*56	*57	....	....
Davis-Daly	Boston	2⅛	2⅛	2⅛	Mar. '20, Q	0.25
East Butte	Boston	5⅜	5⅜	5⅜	Dec. '19, A	0.50
First National	Boston Curb	†30	†35	....	Feb. '19, SA	0.15
Franklin	Boston	1⅛	1⅛	1⅛	....	....
Gadsden Copper	Boston Curb	45	45	45	....	....
Granby Consol.	New York	17⅛	17	17	May '19, Q	1.25
Greene-Cananea	New York	16⅛	16	16	Nov. '20, Q	0.50
Hancock	Boston	3	3	3	....	....
Howe Sound	N. Y. Curb	3⅛	3⅛	3⅛	Jy. 2, Jy. 16	0.05
Inspiration Consol.	New York	29⅛	28	28	Je. 14, Jy. 2 Q	0.50
Iron Cap	Boston Curb	†4	†4½	....	May 23, K	0.15
Isle Royale	Boston	....	....	21⅛	June '23, Q	0.50
Kennecott	New York	34½	33	33⅞	Je. 8, Jy. 2 Q	0.75
Keweenaw	Boston	....	....	80	....	....
Lake Copper	Boston	....	....	1⅜	....	....
Magma Copper	New York	30½	29½	30	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	2	1⅞	1⅞	....	....
Mass Consolidated	Boston	....	....	1⅛	Nov. '17, Q	1.00
Miami Copper	New York	23⅜	23	23⅛	Au. 1, Au 15, Q	0.50
Michigan	Boston	1⅞	1⅞	1⅞	....	....
Mohawk	Boston	43	41	41	June '23, Q	1.00
Mother Lode Coa.	New York	9⅜	9	9⅛	Je. 8, Je. 30, Q	0.50
Nevada Consol.	New York	11⅛	11⅛	11⅛	Sept. '20, Q	0.25
New Cornelia	Boston	18⅝	17⅞	18⅛	Au. 3, Au. 20, Q	0.25
North Butte	Boston	2⅛	2⅛	2⅛	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*70	*65	*66	....	....
Old Dominion	Boston	18	18	18	Dec. '18, Q	1.00
Osceola	Boston	31⅛	31	31	June '23, Q	1.00
Phelps Dodge	Open Mar.	†150	†160	....	Je. 20, Jy. 2 Q	1.00
Quincy	Boston	26⅛	25⅞	26	Mar. '20, Q	1.00
Ray Consolidated	New York	10⅜	10	10⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	*89	*82	*82	....	....
St. Mary's Min. Ld.	Boston	34	32	32	Mar. '23, K	3.00
Seneca Copper	New York	7⅞	7⅞	7⅞	....	....
Shannon	Boston	....	....	*55	Nov. '17, Q	0.25
Shattuck Arizona	New York	5⅜	5⅜	5⅜	Jan. '20, Q	0.25
South Lake	Boston	1	*98	*98	....	....
Superior & Boston	Boston	1⅛	1	1	....	....
Tenn. C. & C. cfs.	New York	9⅛	8⅞	8⅞	Je. 30, Jy. 16, Q	0.25
Tuolumne	Boston	....	....	*14⅛	May '13,	0.10
United Verde Ex.	N. Y. Curb	29	29	29	Jy. 5, Au. 7, Q	1.00
Utah Consol.	Boston	1⅛	1⅛	1⅛	Sept. '18,	0.25
Utah Copper	New York	60	58	58	Je. 8, Je. 30, Q	1.00
Utah Metal & T.	Boston	*60	*55	*55	Dec. '17,	0.30
Victoria	Boston	....	....	*25	....	....
Winona	Boston	*70	*60	*60	....	....
Wolverine	Boston	7	6	6⅛	....	....
NICKEL-COPPER						
Internat. Nickel	New York	12⅛	11⅝	12	Mar.' 19,	0.50
Internat. Nickel pfd.	New York	....	....	79⅛	Jy. 19, Au. 1	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	3⅛	3⅛	3⅛	....	....
National Lead	New York	113	112⅛	112⅛	Se. 16, Se. 29 Q	2.00
National Lead pfd.	New York	....	....	111⅛	Au. 24, Se. 15 Q	1.75
St. Joseph Lead	New York	18⅛	17⅛	17⅛	Se. 9, Se. 20 Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	9	9	9	May '20,	1.00
Am. Z. L. & S. pfd.	New York	34	31	31	Nov. '20, Q	1.50
Butte C. & Z.	New York	6	5⅞	6	Mar. '23,	0.50
Butte & Superior	New York	19⅛	17⅞	17⅞	Je. 15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	5⅜	5⅜	5⅜	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	151⅞	150	151⅞	Jy. 31, Au. 10 Q	2.00
United Zinc	N. Y. Curb	....	....	*80	....	....
Yellow Pine	Los Angeles	....	....	*60	June '23, Q	0.03
SILVER						
Alvarado	N. Y. Curb	....	....	3⅜	Dec. '07, I	0.12½
Batopilas Mining	New York	⅛	⅛	⅛	May '20, K	0.03
Beaver Consol.	Toronto	*33⅜	*33	*33⅜	....	....
Candelaria	N. Y. Curb	*6	*5	*6	....	....
Castle-Trethewey	Toronto	*25½	*25	*25½	May '21, Q	0.12½
Coniagas	Toronto	2.60	2.60	2.60	Jan. '17,	0.05
Crown Reserve	Toronto	*60	*60	*60	....	....
Hilltop-Nev.	N. Y. Curb.	*24	*15	*15	....	....
Kerr Lake	N. Y. Curb	2⅜	2⅜	2⅜	Jy. 2, Jy. 16, Q	0.12½
La Rose	Toronto	*33	*33	*33	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*16⅛	*15	*15	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.40	2.30	2.30	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	Jy. 1, Jy. 20 Q	0.15
Ontario Silver	New York	....	....	3⅜	Jan. '19, Q	0.50
Temiskaming	Toronto	*38	*38	*38	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div
GOLD						
Alaska Gold	New York	¼	¼	¼	....	....
Alaska Juneau	New York	1	¼	1	....	....
Boundary Red M.	N. Y. Curb	*14	*12	*12	....	....
Carson Hill	Boston	5⅛	5⅛	5⅛	....	....
Cresson Consol. G.	N. Y. Curb	3⅜	3⅜	3⅜	July '23	2.00
Dome Mines	New York	35	34¼	35	Je. 30, Jy. 20 Q	1.00
Golden Cycle	Colo. Springs	1.04	1.04	1.05	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	12.00	11.80	12.00	Jy. 26, Au. 13 M	0.05
Homestake Mining	New York	....	....	62	Au. 20, Au. 25 M	0.50
Kirkland Lake	Toronto	*34	*34	*34	....	....
Lake Shore	Toronto	3.45	3.40	3.45	Au. 1 Au. 15 '23, Q	0.02
McIntyre-Porcupine	New York	16½	16¼	16¼	Au. 1, Se. 1, Q	0.25
Portland	Colo. Springs	†*30	†*40	*35	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1⅜	1 1/16	1⅜	....	....
Tom Reed	Los Angeles	*43	*43	*43	Dec. '19,	0.02
United Eastern	N. Y. Curb	1¾	1 1/16	1 11/16	Jy. '28, Q	0.15
Vipond Cons.	Toronto	*64	*63	*63	....	....
Wright-Hargreaves	Toronto	....	....	3.05	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	1½	1½	1½	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*13	*13	*13	....	....
Con. Cortez	N. Y. Curb	*70	*66	*70	....	....
Con. Virginia	San Francisco	10⅛	8	10⅛	....	....
Continental Mines	N. Y. Curb	5⅛	5	5	....	....
Dolores Esperanza	N. Y. Curb	1⅜	1⅛	1⅛	Jy. 1, Jy. 10 Q	0.05
Jib Consol.	N. Y. Curb	*	....	*70	....	....
Tonopah Belmont	N. Y. Curb	*68	*68	*68	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*54	*52	*54	May 23	0.10
Tonopah Extension	N. Y. Curb	2	1⅞	2	Je. 9, Jy. 2	0.05
Tonopah Mining	N. Y. Curb	1⅜	1⅜	1⅜	Apr. '23, Q	0.07½
Unity Gold	N. Y. Curb	3⅜	3⅜	3⅜	....	....
West End Consol.	N. Y. Curb	*84	*82	*83	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	16½	16½	16½	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	....	....	*55	Dec. '20,	0.15
Chief Consol.	Boston Curb	3⅜	3⅜	3⅜	Au. 1, '23, Q	0.10
Columbus Rexall	Salt Lake	*45	*41	*41	Aug. '22,	0.03
Consol. M. & S.	Montreal	26½	25	26½	Oct. '20, Q	0.62½
Erupcion	Boston Curb	3	2⅞	2⅞	Apr. '23, Q	0.125
Federal M. & S.	New York	....	....	8	Jan. '09,	1.50
Federal M. & S. pfd.	New York	37	37	37	June '23, Q	1.75
Florence Silver	Spokane	27⅞	25	25	Apr. '19, Q, X	0.01½
Hecla Mining	N. Y. Curb	7⅛	7⅛	7⅛	Je. 15 Q	0.50
Iron Blossom Con.	N. Y. Curb	*23	*23	*23	July 16,	0.02½
Marsh Mines	N. Y. Curb	....	....	*7	June '21, I	0.02
Park City	Salt Lake	....	....	3.25	Je. 15, Jy. 2 Q	0.12½
Park Utah	N. Y. Curb	....	....	2⅜	Je. 15, Jy. 2 Q	0.15
Prince Consol.	Salt Lake	*2	*1⅛	*2	Nov. '17,	0.02½
Silversmith	Spokane	*34⅛	*33	*33	Jy. 2, Jy. 10	0.02
Simon Silver-Lead	N. Y. Curb	*20	*10	*10	....	....
Snowstorm Silver-L.	N. Y. Curb	....	....	*43	....	....
Tamarack-Custer	Spokane	1.20	1.20	1.20	Je. 30, K	0.02
Tintic Standard	Salt Lake	2.92½	2.90	2.90	July '23	0.15
Utah-Apex	Boston	3⅜	3⅛	3⅛	June '23, Q, X	0.50
IRON						
Bethlehem Steel	New York	48⅛	46⅜	48⅛	Se. 1, Oc. 1 Q	1.25
Char. Iron	Detroit	1	1	1	....	....
Char. Iron pfd.	Detroit	....	....	1⅜	....	....
Colorado Fuel & Iron	New York	27	26	26½	Au. 10, Au. 25 Q	2.00
Col. Fuel & Iron pfd.	New York	....	....	102	Feb. '23, Q	2.00
Gt. North'n Iron Ore	New York	27½	26½	27½	Apr. '23	1.00
Inland Steel	N. Y. Curb	....	....	46½	Au. 15, Se. 1 '23 Q	0.62½
Mesabi Iron	N. Y. Curb	6⅜	6⅛	6⅜	....	....
Replogle Steel	New York	11⅛	9⅜	11⅛	....	....
Republic I. & S.	New York	44⅜	42⅜	42⅜	May '21	1.50
Republic I. S. pfd.	New York	91	89	89	Se. 15, Oc. 1 Q	3.75
Sloss-Sheffield S. & I.	New York	42	42	42	Feb. '21	1.50
Sloss-Shef. S. & I. pfd.	New York	....	....	78	Je. 22, Jy. 2 Q	1.75
U. S. Steel	New York	89⅛	86⅛	88⅜	Au. 30, Se. 29, Q	1.25
U. S. Steel pfd.	New York	117⅛	116⅛	117⅛	Au. 7, Au. 30 Q	1.75
Virginia I. C. & C.	New York	....	....	52	Je. 16, Jy. 2	2.00
Virginia I.C. & C. pfd.	New York	....	....	78⅛	Je. 16, Jy. 2	2.50
VANADIUM						
Vanadium Corp.	New York	30	26⅜	28⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	51⅛	47	49⅛	Je. 30, Jy. 15 Q	1.50
Asbestos Corp. pfd.	Montreal	74⅛	74	74⅛	Je. 30, Jy. 15 Q	1.75
SULPHUR						
Freeport Texas	New York	12	10⅛	12	Nov. '19, Q	1.00
Texas Gulf	New York	57⅛	53⅜	55⅛	June '23, Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅜	3⅛	3⅛	....	....
MINING, SMELTING AND REFINING						
Amer. Metal	New York	42⅜	42⅛	42⅜	Au. 20, Se. 1	0.75
Amer. Metal pfd.	New York	....	....	110	Au. 18, Se 1	1.75
Amer. Sm. & Ref.	New York	57⅛	55	56⅜	Jy. 9, Au. 1	1.25
Amer. Sm. & Ref. pfd	New York	96	95½	96	Au. 10, Se. 1 Q	1.75
U. S. Sm. R. & M.	New York	23⅞	23½	23⅞	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	42⅛	42⅛	42⅛	Jy. 6, Jy. 15 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

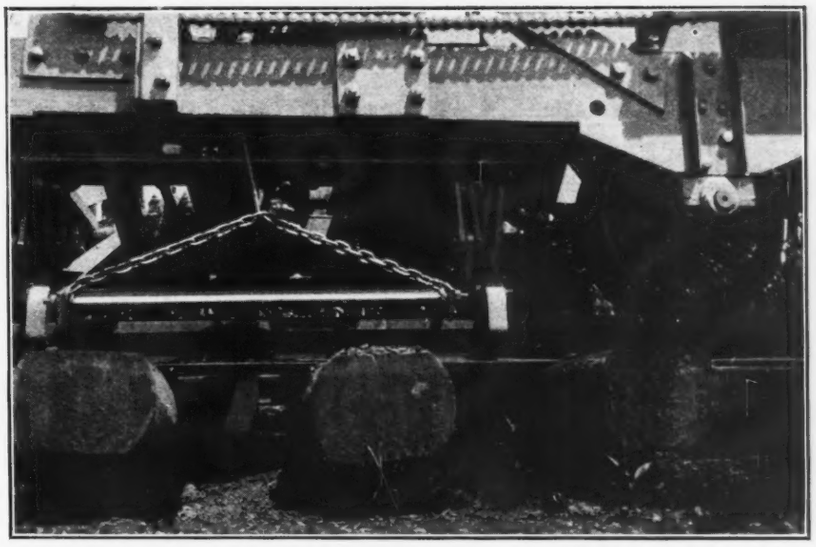
Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

NEW MACHINERY AND INVENTIONS

New Machine Facilitates Work of Shifting Track

Track may easily be shifted on dumps, in open pits, on contractor's and railroad construction, and on other like work by a new machine that is now being made by the Lake Superior Loader Co., of Duluth, Minn. It is known as the Peterson track shifter. It is entirely self-contained, and can be moved under its own power at a maximum speed of 30 miles an hour to the section of track to be shifted. Its rear platform will hold eight men and necessary tools.

On reaching the track to be shifted, the rail clamps are hooked over the ball of the rail and the spud is racked down with the shoe between the ties on the side of the track toward the intended shift (Fig. 1).



How track and ties are lifted out of ground for regrading, tie replacement, building up dumps, or reballasting

Track shifter holds track and ties in this position until fill is made or blocking is effected.

Track shifter shifting track on waste dump on Mesabi Range

Spud can be seen in tilted position and whole mass is sliding over to new position

The entire machine is then racked up on the spud, thus raising the rails and ties up on one side. The tilt of the spud then starts the whole raised mass sliding over to the intended side (Fig. 2). After reaching the maximum height of lift, the leverage exerted gently slides the entire track section over to the new position. The rail clamps are then loosened, the machine is moved forward two rail lengths, and the operation is repeated. It is claimed that this is done without disjointing any rail (Fig. 3).

The machine is also intended for raising track in alignment work and ballasting and in replacing ties. To raise the track, the spud is racked down in the center of the track with no tilt. The machine, clamped to the rail, is then racked up, thus lifting the entire track section and allowing ample room for ballasting and tamping. When the track is deeply imbedded or frozen, the track shifter runs along for a few rail lengths and loosens the ties first. This takes only a short time and allows the machine to return and lift a section without danger of kinking the rail (Fig. 4).

Recently the track shifter with six men shifted 1,500 ft. of standard-gage track over a distance of 10 ft. in two and a half hours. The superintendent on the job estimated that it would take twenty men with jacks and crowbars to do the same work in eight hours. On this particular job it was not possible to get that number of men to do the work.

Analytical Balance Weights

The Thompson Balance Co., of Denver, Colo., which has for many years specialized in the manufacture of high-precision weights for gold and silver assaying, is offering a superior line of analytical weights. These double-checked high-grade weights are for use in scientific and technical laboratories where absolute accuracy in weighing is required. Gram weights are of Tobin bronze, gold-plated or brass lacquered; fractionals from 500 mg. to 50 mg. are gold or platinum as desired; 20 mg. to 1 mg. are aluminum. The weights are adjusted within the tolerance prescribed by the Bureau of Standards for high-grade analytical weights and are put up in a box of polished mahogany with velvet-lined pockets.

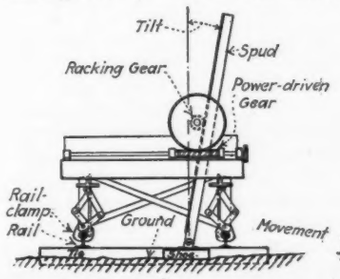


Fig. 1—Preparing to shift

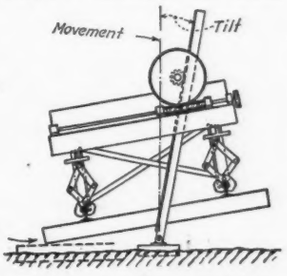


Fig. 2—Lift and shift

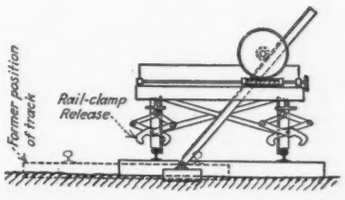


Fig. 3—Ready to move forward

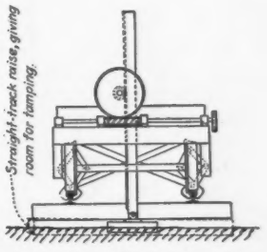


Fig. 4—Raising track

INDUSTRIAL NOTES

Making Leather Belts Endless—II

By Louis W. Arny

The tools required for making leather belts endless and the procedure for making laps have already been described on pages 175 and 176 of the *Journal-Press* of July 28. Further details are given by Mr. Arny as follows:

Belts which are to be made endless may be divided into three classes:

Those which have been endless, and which it is desired to shorten.

Those which have been running with a laced or metal-fastened joint.

New belts which have not yet been placed upon the pulleys.

These again comprise two classes:

Those which are small enough to throw off the pulley, and to take to a near-by bench.

Those which, because of their size, must be worked upon while in place on the pulleys.

To Shorten Narrow Belts Which Have Been Made Endless

With the first of these classes, the belt has been running endless, but has stretched a little, so that the tension is reduced and it becomes desirable to shorten it. If it is a narrow belt, which easily may be thrown on the pulley, it first is necessary to determine how much shorter the belt must be. When this is decided, find the joint which was made when the belt was last put on, and, with the point of the screwdriver, carefully open it, running the screwdriver under the point of the lap and working it toward the heel, taking care not to tear the leather.

If it is a double belt, each ply of leather may have its own lap; or if it is a narrow belt, it may have such a lap as is used on a single belt. Remove the belt to the bench; inspect carefully to see from which end it is most desirable to cut, in its relation to any other joints in the belt, and then bring the end on which it is decided to work nearly to the end of the bench, clamp the belt to the bench with bench clamps, and proceed to cut back the laps the amount of the desired distance.

To Make an Endless Joint in a Belt Which Has Been Laced or Hooked

When it is desired to substitute an endless joint for a laced or hooked joint, the procedure is a little different. If the belt is loose enough on the pulleys so that it can be tightened a number of inches equivalent to the number required to make the endless joint, the process consists in removing the belt to the bench as before, and making the necessary lap. If it is a single leather belt, or if it is a narrow double, say under 6 in., an ordinary single lap may be readily employed. This lap should be from 4 in. to 6 in. long, according to the width. The process then may be completed as described. If the belt is an old one, and the surface of the lap when made appears to be greasy, it should be cleaned with gasoline before attempting to cement it.

Where the belt is not long enough to provide from its stretch sufficient material for the lap, it becomes necessary to prepare a piece to set into the belt. If it is a single belt, this may be a very short piece of belting with a lap on each end, and then laps must be cut upon the old belt to fit this piece, and the cementing process applied as described. Where it is a narrow double belt, the piece inserted may be made in exactly the same way, but for a wider double belt the piece should be arranged so that it provides a separate joint for each of the two plies of the double belt, and that these two joints are "broken" so that they do not come together. The ends of the belt then may be fitted to this insert.

Wider Belts Which Cannot Conveniently Be Carried to the Bench

Working With Clamps

If an old belt is to be shortened, first find the point on the belt at which the joint has been made, and bring the belt around to a place between the two pulleys where it may be most convenient to work. Then put on the clamps, one of the jaws above and one below the joint.

In putting on belts with clamps the first requisite is to see that the middle line of the width of the belt corresponds exactly with the middle line of the distance between the centers of the rods of the clamps. Most clamps have this point marked on them.

The next point, and a most imperative one, is that each pair of jaws of the clamps shall be exactly square with the edges of the belt. A little care here in drawing up evenly on the two rods will bring the two ends of the belt square and true, and will save effort and possibly will avoid having a crooked belt.

Apply enough pressure to the clamps to take the tension of the belt off the joint, and then open the joint with the screwdriver, as before, cut down the new lap on one end with the spokeshave and the scraper, scrape off all the old glue from the lap on the other end, and proceed as before. This work can be best done on a clamp board, which fits between the rods and is attached to them.

Making New Belts Endless

In putting on new belts, the laps should be made and the belt drawn over the pulleys, and then the clamps adjusted as above described. If the belt is to be bought, give the belt maker the exact length around the pulleys, stating whether it has been measured with a steel tape, a cotton tape, or a string, and let him make the allowances, and tell him to make it "endless-open laps." It then will come to hand ready to be placed around the pulleys and cemented.

In the case of new belts which it is desired to place on the pulleys endless, the first thing is to get the proper length of the belt. It is usual to estimate that the belt should be one-eighth of an inch to the foot, or 1 per cent, less than the actual steel-tape measure around the pulleys, and for small belts which are to be thrown on the pulleys without the use of clamps, this will be found to be sufficiently accurate. For those belts which are to be put on with clamps, or where it is necessary that the belt shall be tight to produce tension, this allowance may be increased slightly, but not much. For single belts to this length must be added the length of one lap, and the belt may be cut to this total length, and the laps prepared and cemented in the manner that has already been described.

For double belts, the plies should be opened for a little distance from the ends of the belts. This distance must vary with the width of the belt, and consequently the length of the lap desired, and with any other joints which may be near the ends. It may be desirable to make it long enough on one side of the belt or the other to include an existing lap, so that two of them shall not come close together on the same side of the belt. This distance must be long enough so that each lap will have a piece of whole leather on the opposite side. When this distance is determined, one side of one end must be cut back the proper distance, and the opposite side of the other end. Then the laps may be made on both of the two sides, on both of the two ends, as described. New belts can be prepared best at the bench. If it is a belt of any size it may take some effort to bring the two ends close enough to slip the clamp rods into place. Clamps for very wide belts usually are made with a heavy screw-eye bolt in one of each pair of blocks, so that a chain hoist or a block and tackle may be used to bring the ends of the belt to a point where the rods may be inserted.

With a new belt it is necessary to pull it up to a point where the laps fit perfectly. Then an observation should be made to see whether the belt is sufficiently tight. There may have been an error in measurement or an insufficient allowance for stretch. If it is decided that the belt is not tight enough, it is a simple matter to scrape back the laps for enough to tighten it sufficiently, unless there has been a gross error.

There is some sort of agreement among belting men that single belts should be put on so that they have an initial tension, before starting, of 72 lb. per inch of width, and double belts in proportion. Ordinarily, there is at hand no method of measuring this tension; it becomes a question of judgment of the operator, and he must endeavor to judge accurately the proper tension which should be applied, by watching the performance of his belts after they have been running, and gaging the frequency with which they have to be "taken up."